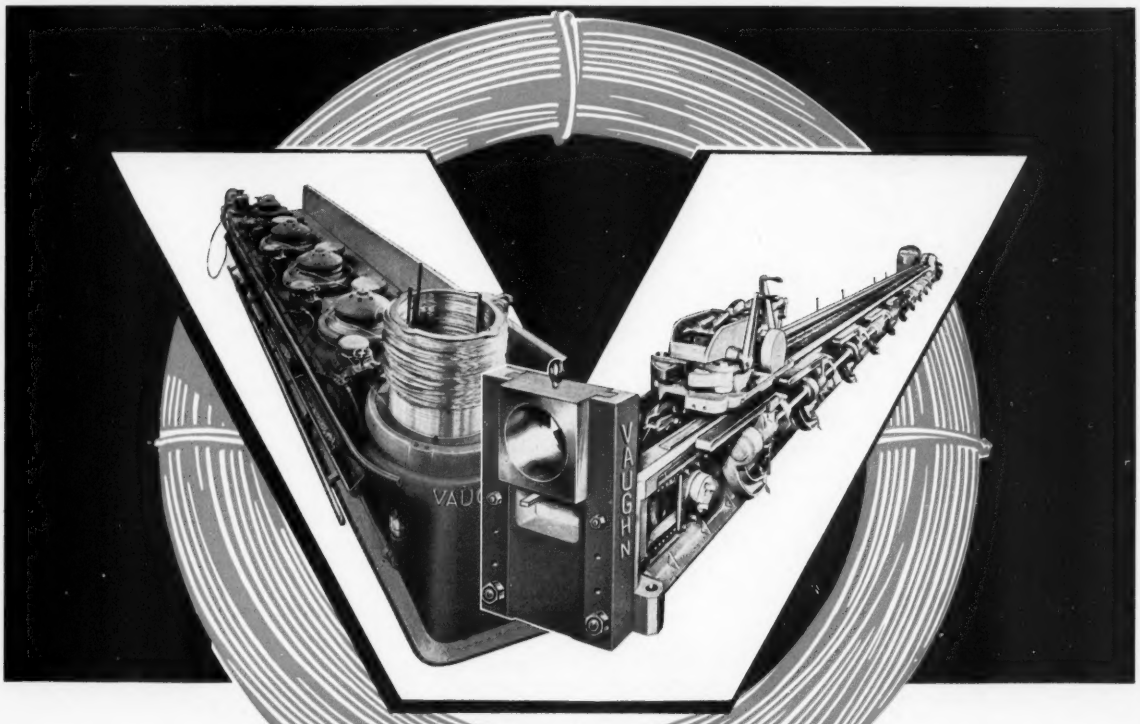
WIRE AND WIRE PRODUCTS

MAY 1942



For Victory...

IN THE RACE FOR GREATER COLD DRAWN PRODUCTION!

Regardless of whether the product is wire... rod... bar or tube, the need is for *more!* These products, ferrous or non-ferrous, are handled *faster*—with complete dependability—by the complete range of Vaughn Motoblocs, Motoblox and Draw Benches available to the manufacturer with urgent war contracts. Write today!

V

PRODUCTS

Complete cold drawing equipment . . . continuous or single hole . . . for the largest bars and tubes . . . for the smallest wire . . . ferrous, non-ferrous materials or their alloys.

THE VAUGHN MACHINERY CO.

CUYAHOGA FALLS, OHIO, U. S. A.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

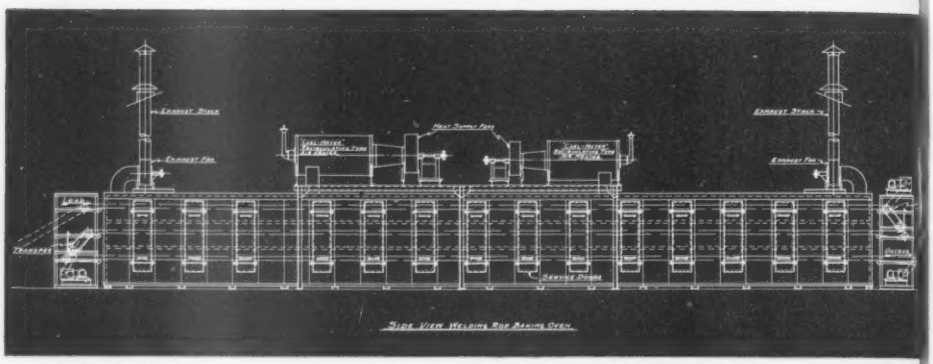
USED EXTENSIVELY IN WAR PRODUCTION!

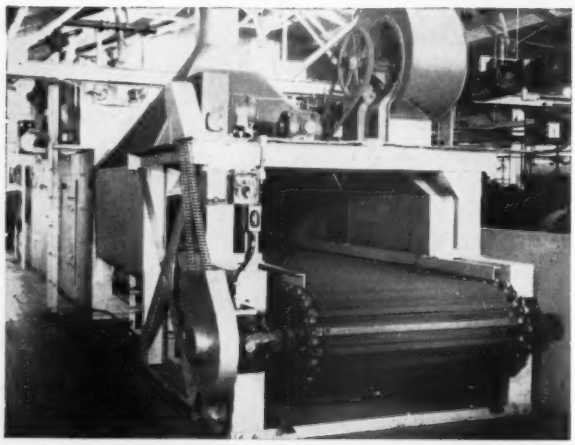
CARL-MAYER Furnaces, Welding Rod Ovens, Rod Bakers

Over 20 Years Experience

CARL-MAYER WELDING ROD OVENS

The number of installations for Hollup Corporation has now reached SIX, proving highly efficient and economical performance in drying coated welding rods. These ovens use the "Mayer" Recirculating Air Heater Principle and Rod Transfer Systems (patents pending).

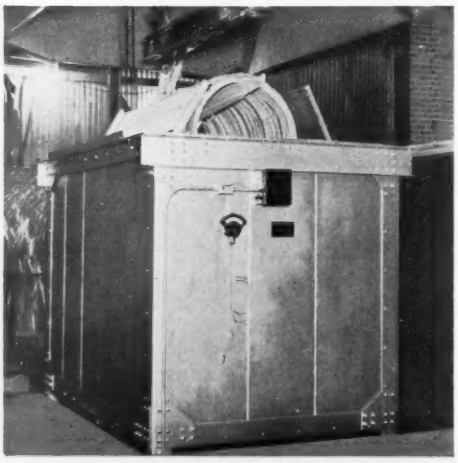




Carl-Mayer's achievements in furnace and oven design, speed and efficiency are a highly important contribution to the efforts of leading plants giving their ALL to provide our armed forces with an abundance of equipment and supplies—quickly. Repeat orders are PROOF of advantages. Carl-Mayer installations average more than three per customer. Wire for a Carl-Mayer Engineer, or write for Bulletin 241.

CARL-MAYER SHOT AND SHELL FURNACES

Seven installed at Bridgeport Brass Co.—two more on order for same plant. Carl-Mayer Recirculating Air Heater Furnaces are used by leading plants because of their unusually fast heating cycle, uniformity—plus or minus 2½°F. and amazingly low fuel consumption.



CARL-MAYER HI-SPEED TRADE MARK ROD BAKERS

THE FASTEST ROD BAKERS BUILT! Save up to 50% in time and fuel. Blow-Off feature removes moisture without bumping or agitating the coils. Ask where to see one in operation.

PATENT NUMBERS:
U. S. A. 2235559
CANADA 396144 and 401589

Other patent claims allowed and pending.

THE CARL-MAYER CORPORATION

3030 EUCLID AVE., CLEVELAND, OHIO

A few Carl-Mayer customers

Allegheny Ludlum Steel Co.
Aluminum Co. of America
Atlantic Wire Co.
Atlas Steel Co.
American Magnesium Corp.
Bridgeport Brass Co.
Eclipse Aviation Division of Bendix Aviation Corp.
Ford Motor Co.
General Motors Corp.
Hollup Corporation
Hyatt Roller Bearing Co.
Johnson & Nephew, Ltd.
Page Steel & Wire Co.
Pittsburgh Tool Steel Wire Co.
Reliance Manufacturing Co.
Steel Co. of Canada
Timken Roller Bearing Co.
Thompson Products Co.
Weatherhead Co.
Wickwire Spencer Steel Co.

TO MEET YOUR WAR-TIME NEEDS STILL FASTER

Announcing

The Appointment Of

HARTLEY WIRE DIE COMPANY

THOMASTON, CONNECTICUT

AS AN

EASTERN MANUFACTURING UNIT

WE announce the appointment of Hartley Wire Die Company — former manufacturing-sales agent for round hole wire drawing dies — as eastern manufacturing unit for the production of ALL TYPES of Carboloy wire drawing, eyelet, ammunition, bolt sizing dies, shape dies, etc. A considerable expansion of facilities in the Hartley plant has been completed for this work. Under this arrangement, large stocks of hardened blank and cored nibs — supplied from the Detroit plant — will be maintained at Thomaston, Connecticut, and finished there for eastern mills.

These additional facilities, supplementing our main plant at Detroit, not only provide for faster, local service for mills in the East, but will also result in generally improved service from the Detroit plant due to the transfer to Thomaston of virtually all die finishing work for eastern mills. Also to be located in the Thomaston plant is the Carboloy Die Service and Stock Maintenance Branch — with the same service personnel — formerly at Worcester, Massachusetts. Maintenance of the office at Worcester, however, will be continued.

With the application of cemented carbides steadily keeping pace with the expanding facilities of industry, this material is daily becoming a more vital factor in the program to speed up production of a wide range of war material. Carboloy Company is continuing to ANTICIPATE demand for war needs. This present step, supplementing construction of our new modern Detroit plant in 1939 and three successive expansion programs in that plant, is in line with the nation's efforts to utilize all existing equipment and man-power already available for production.

With these changes and additions the following improved facilities are now available to all users of Carboloy dies:—

CARBOLOY COMPANY, INC., Detroit, Mich.

Chicago • Cleveland • Detroit • Newark • Philadelphia • Los Angeles • Pittsburgh • Seattle • Worcester, Mass.

MAIN MANUFACTURING PLANT
Detroit, Mich.

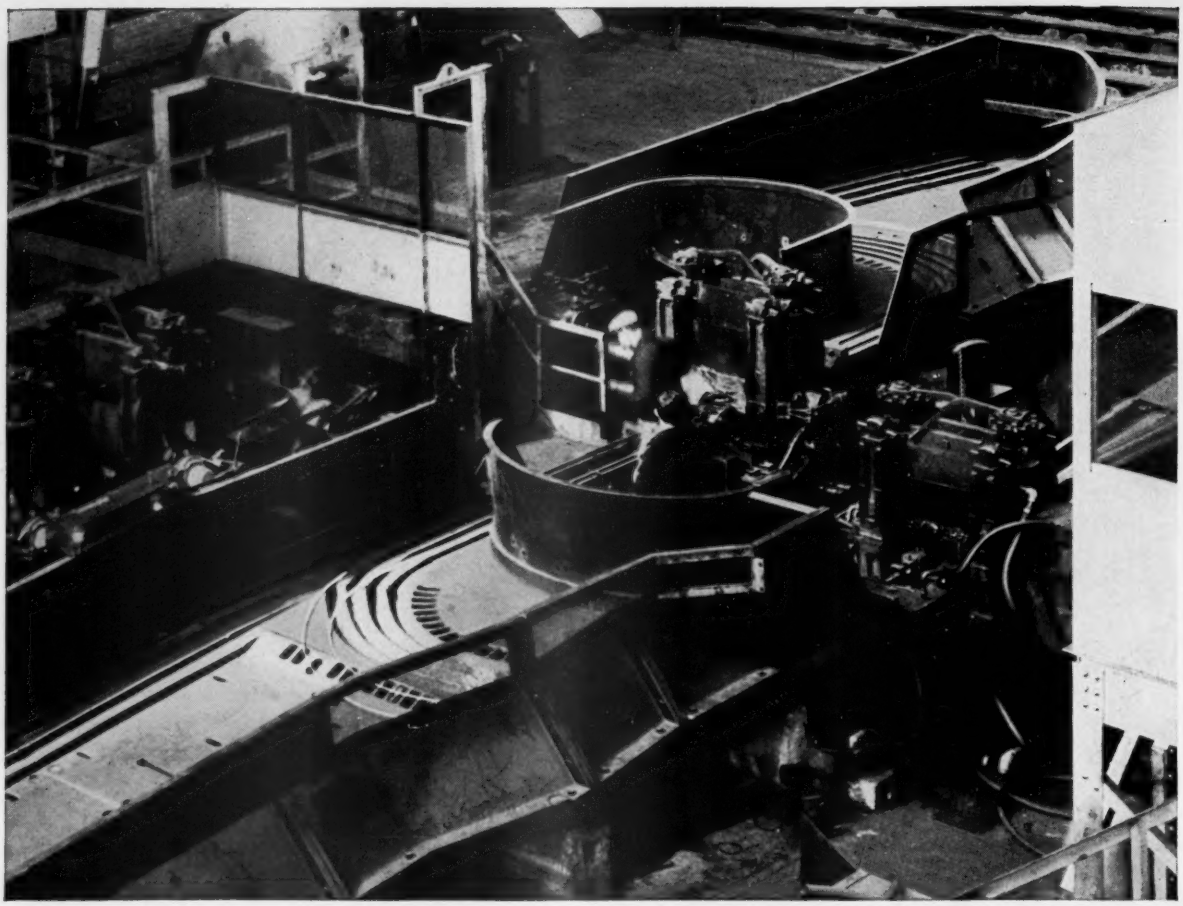
EASTERN MANUFACTURING UNIT
Hartley Wire Die Company
Thomaston, Conn.

CARBOLOY DIE-SERVICING FACILITIES
Chicago - Detroit - Pittsburgh - Thomaston, Conn.
(Stocks of Carboloy standard dies and nibs maintained in all cities above)

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Ont.

CARBOLOY
Reg. U.S. Pat. Off.
CEMENTED CARBIDES
TOOLS - DIES - DRESSERS
CORE BITS - MASONRY DRILLS
- WEAR RESISTANT PARTS -

FOR THE MANUFACTURING · MINING · TRANSPORTATION · CONSTRUCTION INDUSTRIES



How an S-curve helps make better rods

To anyone not familiar with the fine points of making steel rods, it would probably seem absurd to break up a neat straight line of "roll stands" by an S-curve.

Bethlehem does it for a definite purpose:

There are 21 separate roll-stands in Bethlehem's modern rod mill. The rolls in each stand operate faster than their predecessors—from 6 r.p.m. in the first stand to 1500 r.p.m. in the last—a speed of about 3800 feet per minute. It is obvious that the speed of the many rolls must be perfectly synchronized or the rods will be "pushed" or "pulled" as they go through the mill.

By using multiple-motor drive, Bethlehem achieves unusually close synchronization. However, we go farther, and this is where the S-curve, which consists of two so-called "looping" stands comes into action.

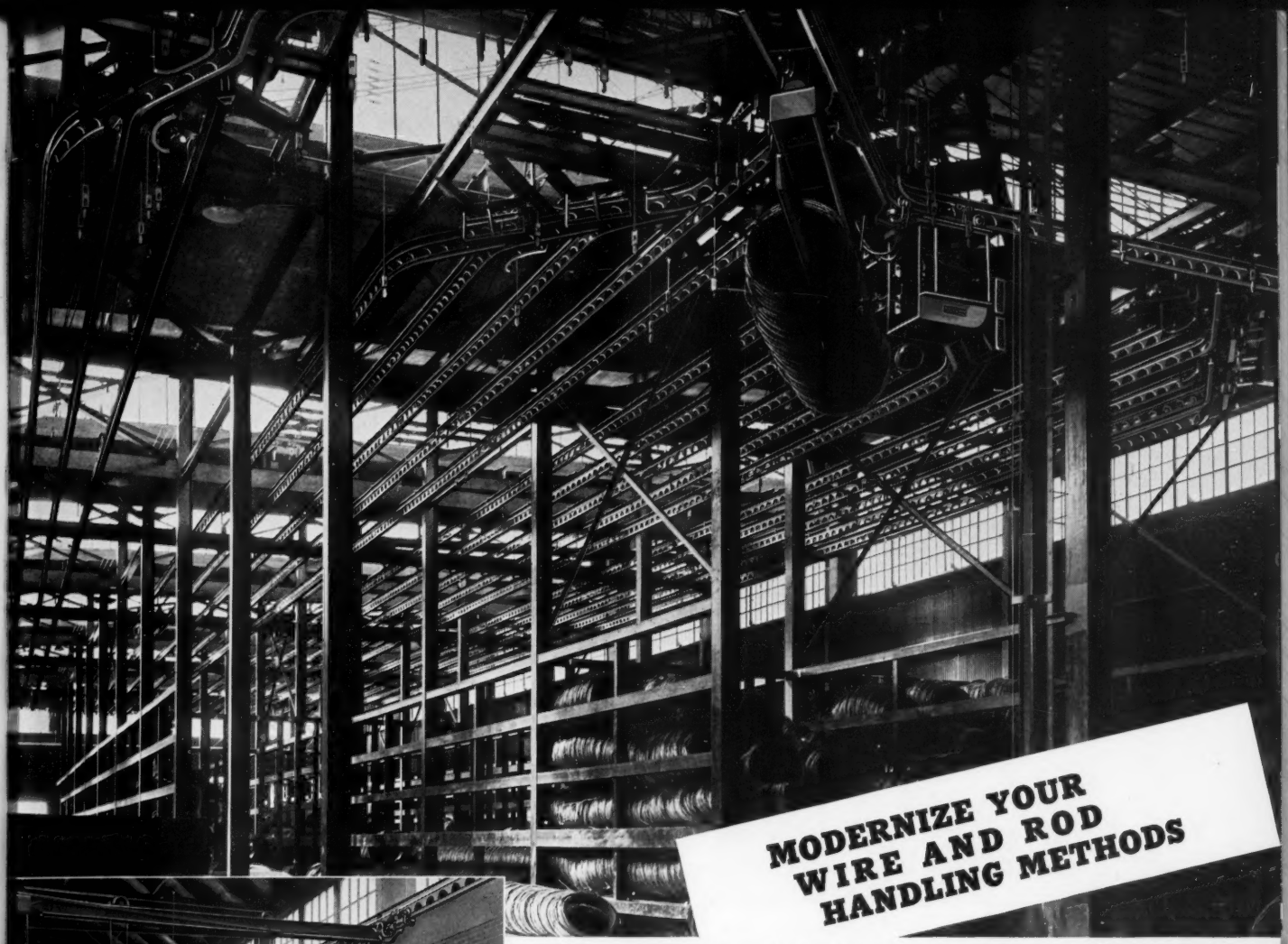
The looping stands act as speed compensators. They reverse the direction of the rods twice, in the form of two U-bends or loops, before feeding the rods into the finishing stands. These loops are free to shorten or lengthen. By so doing, they absorb differentials in speed, give the rods a fresh start entering the seven finishing stands.

The looping stands help us to produce Bethlehem rods faster and better. Quality is not sacrificed to speed. Wire which is made from these rods is top-quality in every respect.

BETHLEHEM WIRE

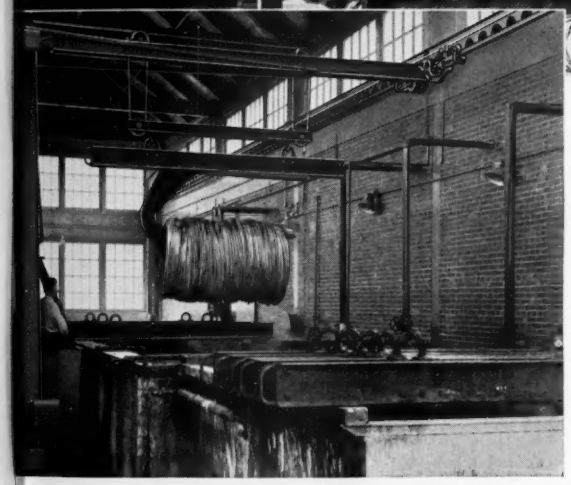
This is one of a series of advertisements which illustrate and describe how Bethlehem Steel Company combines quality standards with utmost speed in producing top-quality rods and wire in the present crisis.

BETHLEHEM STEEL COMPANY



MODERNIZE YOUR WIRE AND ROD HANDLING METHODS

Cleveland Tramrail overhead materials handling systems make use of the ceiling and save valuable aisle space; they greatly increase efficiency of wire handling



Straight-line production methods in cleaning house made possible by Cleveland Tramrail, eliminate congestion and cut handling time

More and more mills and plants fabricating wire and rod are modernizing their handling methods with Cleveland Tramrail. Every year the list of installations grows larger, because Cleveland Tramrail can speed production tremendously and lower costs.

It is often possible to attain goals for greatly increased production without plant expansion or new building construction by the installation of proper Cleveland Tramrail equipment.

Whether you are a small or large producer or fabricator there is Cleveland Tramrail equipment to handle your requirements in every department. There are cleaning house cranes, block-stripping cranes, hairpin-hook carriers and other equipment to streamline your operations, accelerate the production flow and eliminate waste effort.

It will pay you to familiarize yourself with the many possibilities that Cleveland Tramrail offers.

BOOKLET No. 2008 . . Packed with valuable information. Profusely illustrated. Write for free copy on your company letterhead.

GET THIS BOOK!

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
1141 EAST 283RD ST. WICKLIFFE, OHIO.

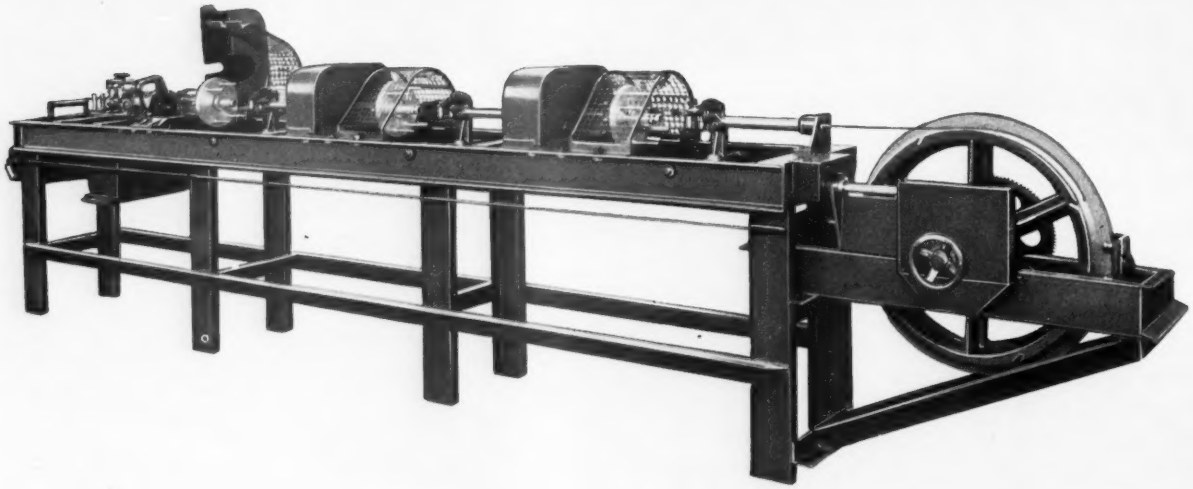
MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSES

CLEVELAND TRAMRAIL

OVERHEAD MATERIALS HANDLING EQUIPMENT

Conserve Rubber.....

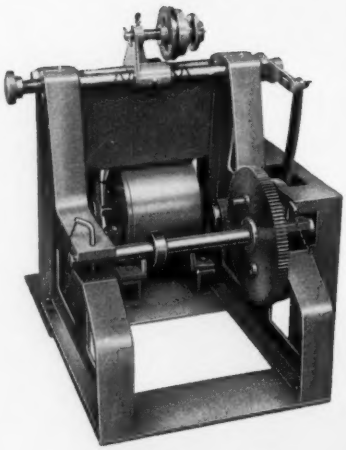
by using other available insulating materials



THE present acute shortage of rubber necessitates large scale substitutions of other suitable insulating materials. This condition will probably exist for the duration, so the wire industry is confronted with the problem of changing from rubber to other insulating materials wherever they are practical.

For serving varnished cambric and all other strip or strand material on #20 B.&S. Gauge stranded or heavier wire, the Syncro Horizontal Magnet Wire Insulating Machine is ideal. This machine can be furnished with any desired number of serving heads and it can be arranged to accommodate universal cops, or pads up to 10" diameter by 5/8" wide. The take-up is controlled by a Syncro Magnetic Slip Clutch, which provides the controlled wire tension that results in uniformly insulated wire.

Write for complete information.



TAKE-UP WITH INDIVIDUAL DRIVE

SYNCRO MACHINE COMPANY

420 LEXINGTON AVE., NEW YORK
McCORMICK BLDG., CHICAGO

REPRESENTED IN CANADA BY CANADIAN ELEVATOR EQUIPMENT CO. LTD., TORONTO

Machinery for the Wire Industry

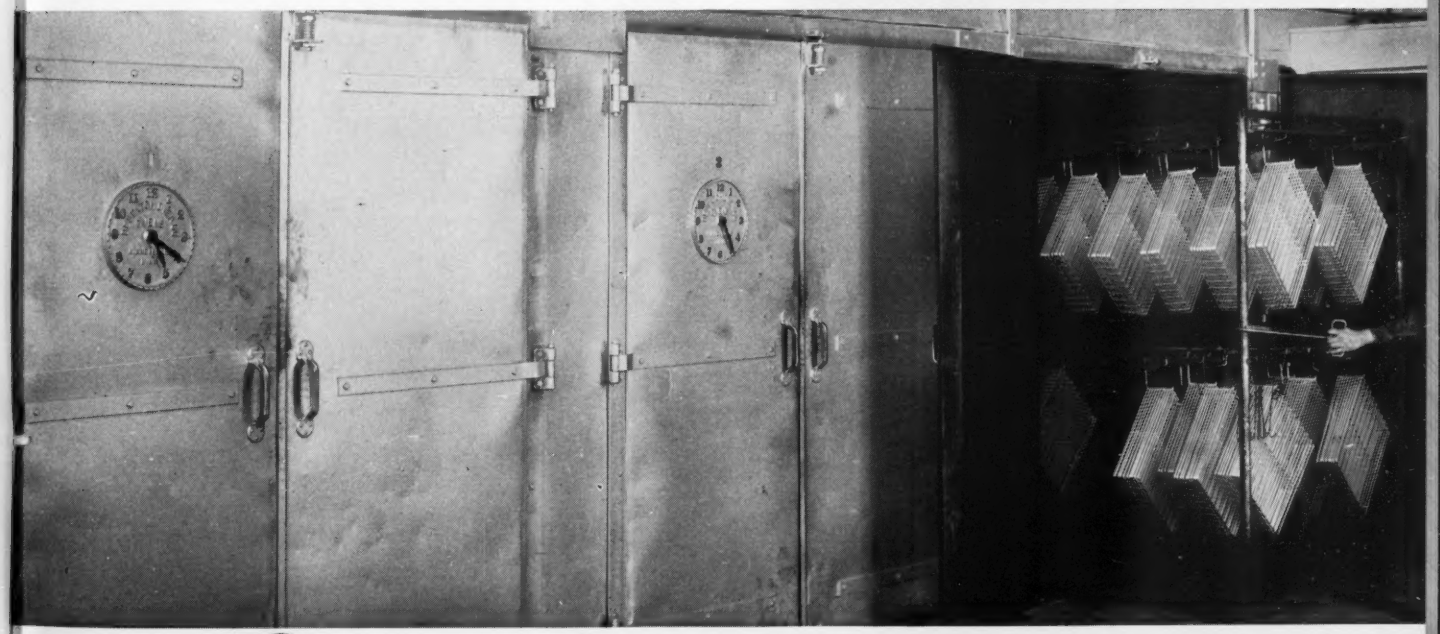
SYNCRO

MACHINES CAN'T TALK —BUT WORKMEN CAN!

Ask skilled operators who work with Continental SUPERIOR wire what they think of it. You will find they agree with hundreds of workmen in other plants that this wire has the working qualities they like. It handles and fabricates uniformly . . . keeps production up—and costs down.

Continental SUPERIOR wire is produced in many special shapes as well as round, and in sizes from 34 gauge to ⅝ inch. Continental's experience in manufacturing *wire for a thousand uses* makes it possible to provide the exact type of wire to assure smoother, faster production in almost any plant.

CONTINENTAL STEEL CORPORATION, Kokomo, Indiana
(The Superior Sheet Steel Co., Canton, Ohio — A Subsidiary)



CONTINENTAL
STEEL CORPORATION

SHEETS: Black, Galvanized, Copperiór, Hot and Cold Rolled, Special Coated, Long Terne, etc.

WIRE: Bright Basic, Annealed, KONIK, Copperod, Tinned, Special Manufacturer's, etc.

IN CONVERTING . . . . . .

Convert to

Vascoloy RAMET

TANTALUM-TUNGSTEN CARBIDE DIES *for*

DRAWING

For drawing fine wire, heavy wire, special shapes, tubing, etc. For shell and cartridge cases from the blank to completed case.

COLD HEADING

Rivets and any number of small upset parts required in large quantities to close tolerance.

COLD NOSING

Artillery shells.

EXTRUDING

For extruding operations on a wide variety of parts because of quantity and tolerance requirements.

Converting to immensely increased quantities of war material at rigid tolerances presents new problems. Even overlooking the item of cost, the down-time of production equipment just for replacing worn dies constitutes a gross waste of time in the necessary war effort.

Large tonnage to close tolerance, minimum friction and die wear, and smooth finish free of score marks — these are the highlights in the performance of Vascoloy-Ramet Tantalum-Tungsten Carbide Dies. These too, are the reasons for converting to such dies wherever high performance must be counted on for uninterrupted day-in-and-day-out production.

Tantalum-Tungsten Carbide Dies are now used for countless forming, nosing, drawing, cupping, and extruding operations on articles of war material. Our special die department offers its services and experience to manufacturers making products requiring these operations.

Tell us your problems. If carbide dies can be used to advantage, we will design and produce Tantalum-Tungsten Carbide Dies that will assure you the ultimate in performance.

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS

DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

IN CANADA: Carbide Tool & Die Company, Ltd., Hamilton, Ont.

4235

TANTALUM-TUNGSTEN CARBIDE

FOR HIGH PERFORMANCE . . . *Specify* Vascoloy RAMET DIES

COPYRIGHT 1942—JONES & LAUGHLIN STEEL CORPORATION

FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

BLAST FURNACE MEN SPEED IRON PRODUCTION FOR MORE FIGHTING STEELS

With the precision of a gun crew in action, a team of skilled men jumps to the task of replacing a burned-out tuyere in their blast furnace. Tools, parts and materials always ready, they snap into action. In a matter of minutes the job is done. The blower opens the wind valve. With a rush and roar the hot blast is on again. Iron for war steel keeps on smelting.

It is this work-coordination of men and management that sets today's record-breaking production pace at J&L.

No waste motions here, no wasted minutes, for these men at the blast furnaces and throughout the works are determined that fighting steels and more fighting steels shall be made *today*.

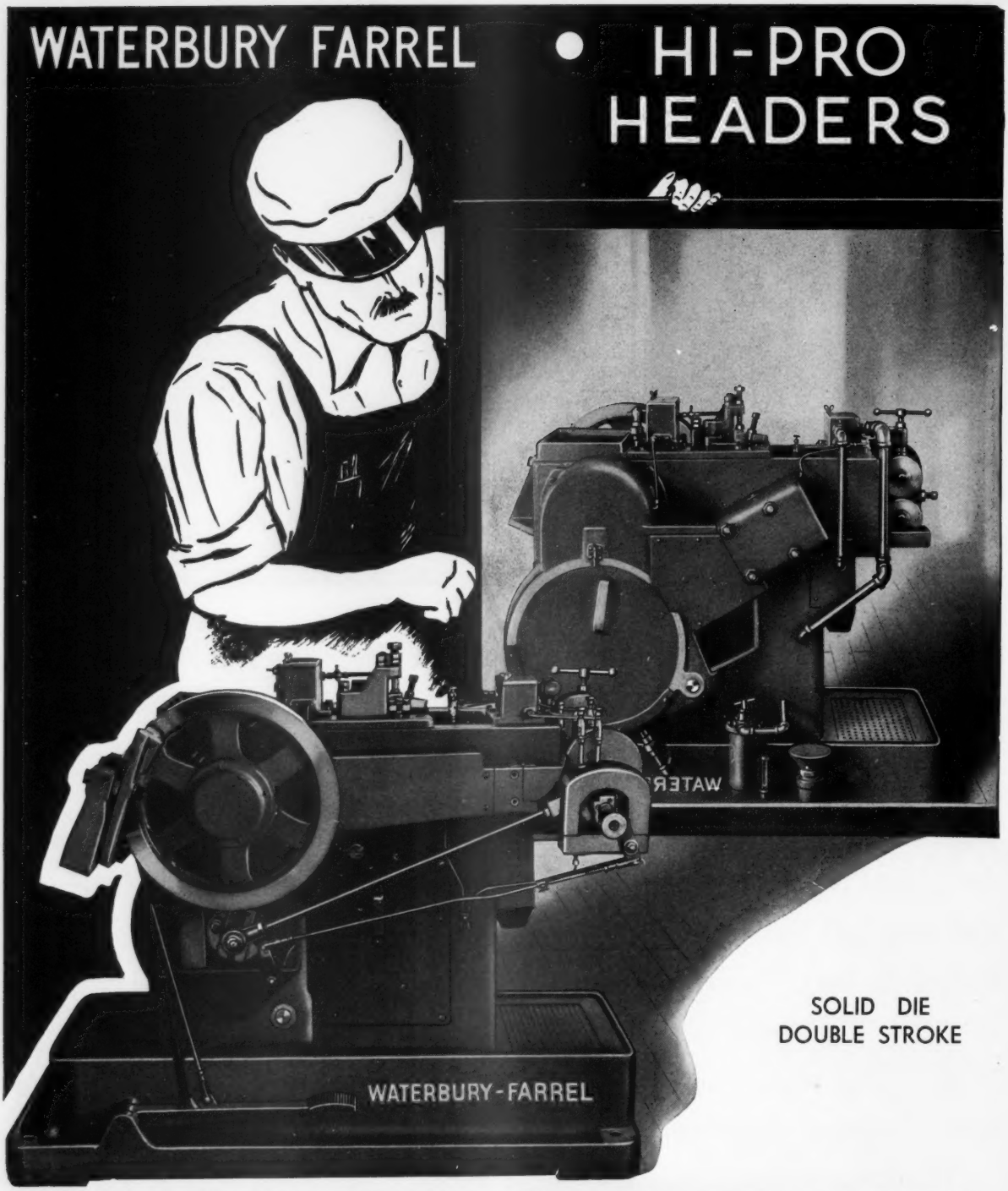
JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS • PITTSBURGH, PENNSYLVANIA

PARTNER TO INDUSTRY IN WAR PRODUCTION

J&L STEEL

WATERBURY FARREL • HI-PRO HEADERS



SOLID DIE
DOUBLE STROKE

For cold-heading rivet and screw blanks—These modern machines are designed to meet the present day demands for high speed, large quantity production, and economical operation — Two standard sizes: 3/16" by 1" at 225 per minute; 5/16" x 1½" at 175 per minute.

WATERBURY FARREL FOUNDRY AND MACHINE COMPANY

WATERBURY, CONNECTICUT

CLEVELAND CHICAGO NEWARK, N. J.

Gentlemen:

To you and to our common cause —now and later— We Pledge Unremitting Effort

Without other change than tightening the belt of our resolve, we here at FIDELITY have shifted from defense to offense in the pace of our production.

As long as eleven years ago we began to prepare for this day.

The matured and disciplined talents of our older and experienced engineers were given the support of keen, young minds whose enthusiasm and vitality they directed into new channels.

New machines and new mechanisms were designed, developed, tested by us and by military and commercial experts. New workers were trained by seasoned and skilled craftsmen.

Old machine tools were obsoleted and replaced with the most modern units until today, with minor exceptions, every machine in the plant is less than five years old. More gages and a larger range of testing equipment were added, so that today tolerances and finishes as fine as four one-millionths of an inch can be measured and maintained.

Organization of tasks, skills and methods were perfected. Both the tempo and the uniform quality of production were so far and so steadily stepped up that today we are producing six times as much per square foot of floor area as six years ago.

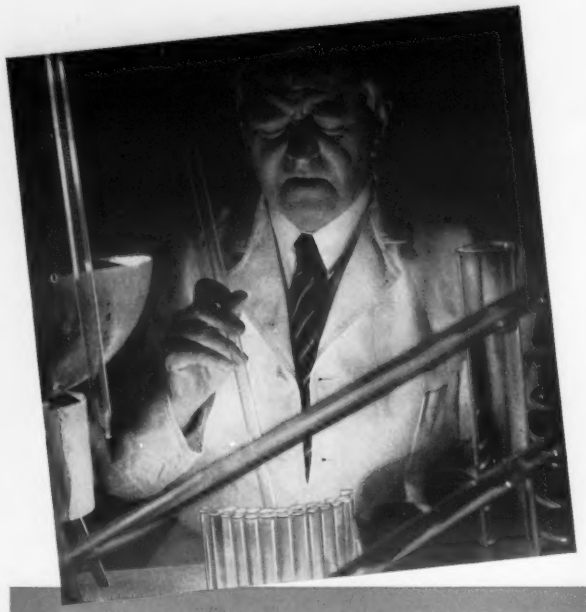
The responsibilities for plans which go beyond even the critical war needs of this year and next have been shouldered by this personnel which has already achieved so much. There is no lag in their planning, designing, development work. It is a task in which all of us are cooperating for the good of all. To its continuance we pledge our unremitting efforts.

Herbert W. Anderson
President

FIDELITY MACHINE COMPANY

3908-18 FRANKFORD AVENUE, PHILADELPHIA, PA.

FIDELITY MACHINES FOR PRECISION



The need for *IMPROVED PRODUCT QUALITY*

Your finished product is your customer's raw material. Improved quality here means greater speed there . . . and that means a step toward Victory.

Quality and speed go hand in hand in Morgan Wire Machinery. Their High Production Factor, like the factor of safety, has always been well above rated capacity.

That's why Morgan Wire Machines are making good today—and will make good in the tougher days to come! May we help you?

MORGAN WORCESTER ENGINEERS AND MANUFACTURERS

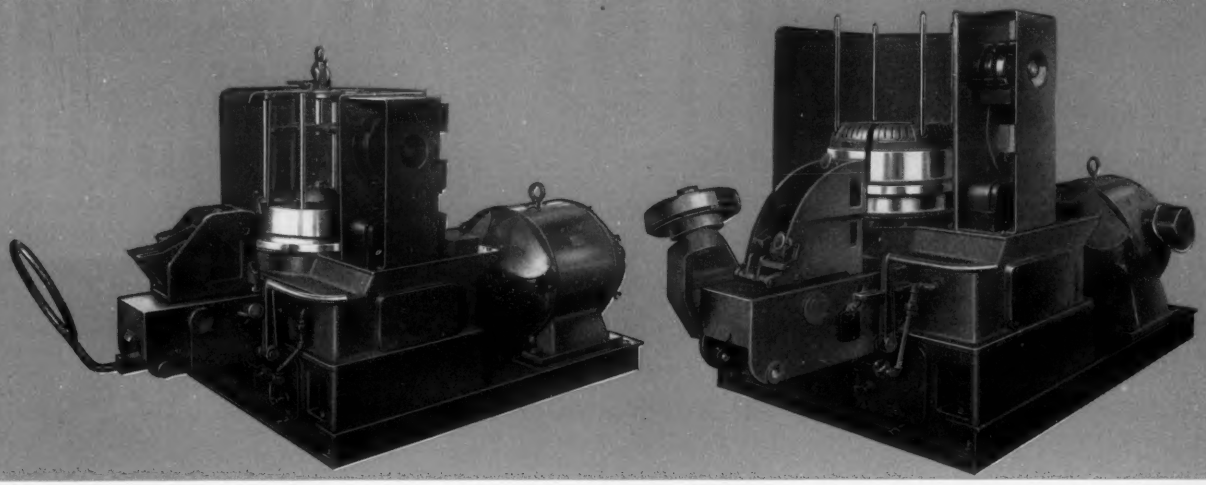
W-73

MORGAN CONSTRUCTION COMPANY, WORCESTER, MASS.
Continuous Wire Drawing Machines; Take-up Frames; Horizontal Bull Blocks; Vertical Spindle Bull Blocks; Reels; Pointers; Wire Mill Accessories.

MORGAN VERTICAL SPINDLE WIRE BLOCKS

Morgan Vertical Spindle Wire Blocks introduce important new features in this type of wire drawing equipment. Single and double deck blocks. Interchangeable blocks. Die boxes fully adjustable for horizontal or vertical cast and equipped to receive all common sizes of die holders.

Each machine is unit powered, driven by combination spiral bevel and helical gears that give high efficiency at all ratios. Air-cooled blocks embody new patented fin-type construction, resulting in great dissipation of heat. Modern safety devices.



WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING—ROLLING—EXTRUDING—FORMING—FABRICATING

Vol. 17 MAY, 1942 No. 5

Designated as

Official Publication By The Wire Association

Contents

Hot Dip Tinning of Carbon Steels as Affected by Variation of Carbon, Phosphorous, Copper, Silicon, Manganese, Aluminum and Titanium (Part I), By Morris E. Fine and Ralph L. Dowdell 237

A New Metal Coating Process ..... By Major A. E. Bellis 244

Powder Metallurgy as a Help to National Defense ..... By Charles Hardy 247

Worcester Regional Meeting 249

War Production Board Announces Changes in Steel Specifications 250

Government Wire Production Information 251

American Iron & Steel Institute Statistics — February, 1942 254

Outstanding Personalities of the Wire Industry 258

Pittsburgh Regional Meeting Program 261

A Review of Recent Wire Patents 262

Electrical Developments in the Steel Industry During 1941 ..... By F. Mohler 264

Index to Advertisers 273

Where to Buy 273-276

—ASSOCIATE EDITORS—

Kenneth B. Lewis, Consulting Wire Mill Engineer
W. H. Spowers, Jr., Consultant on Galvanizing
Lancaster, Allwine & Rommel, Consultants on Patent Information

Richard E. Brown, General Manager
R. S. Spengel, Business Manager
E. D. Sickels, Advertising Manager

Publication Office: Washington, N. J.
Executive Office: Stamford Trust Co. Bldg., 300 Main St., Stamford, Conn.

Annual Subscription, U. S. $5.00, Canada $5.00

50 Cents a Copy in U. S. Issued Monthly Foreign, $7.50

October Convention Issue $1.00 a Copy

January Convention Discussions Issue $1.00 a Copy

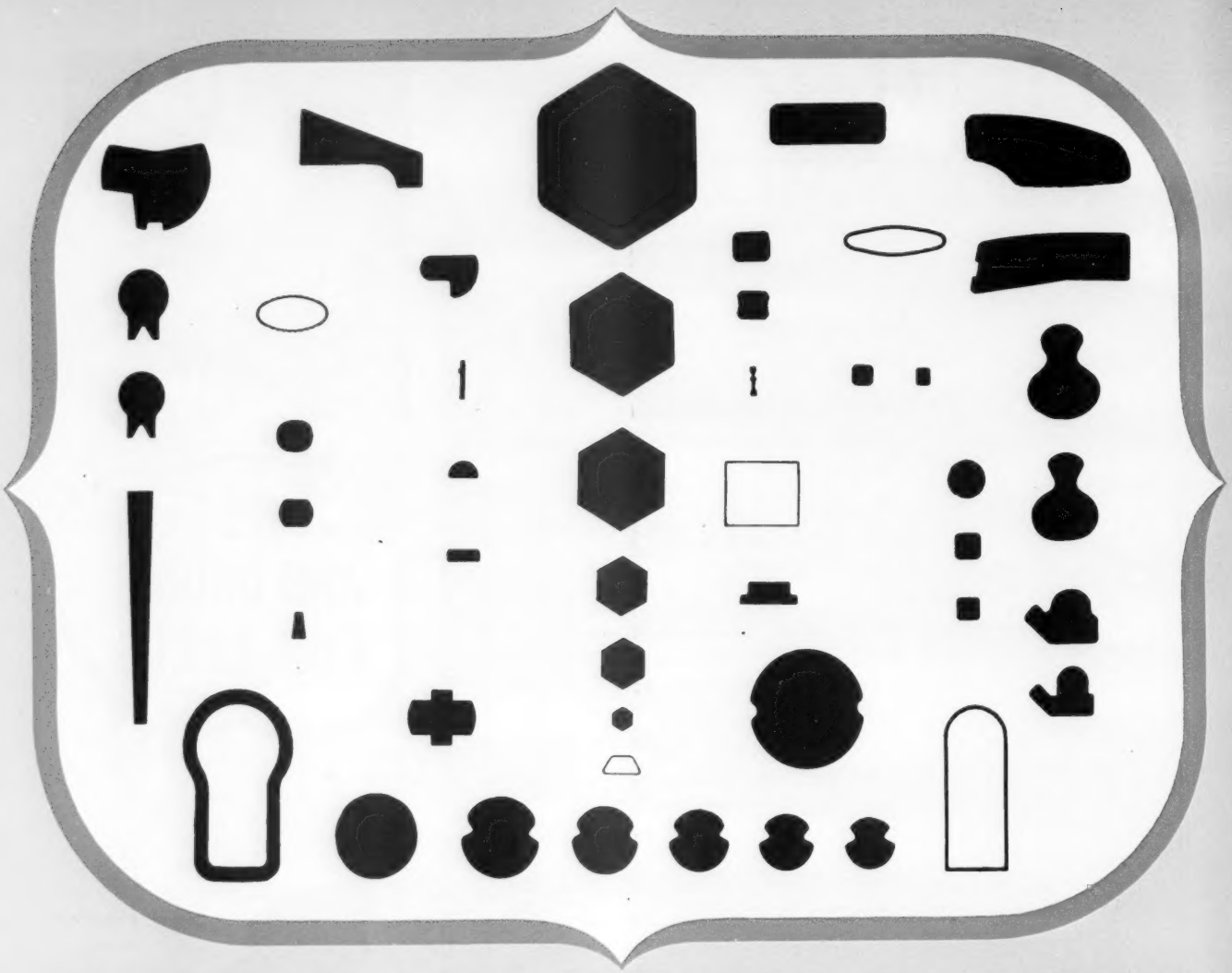
Copyright 1942, Quinn-Brown Publishing Corp. WIRE AND WIRE PRODUCTS is fully protected by copyright and nothing that appears in it may be reprinted wholly or in part without permission.

WIRE & WIRE PRODUCTS, Vol. 17, No. 5, May, 1942, Executive Office, 300 Main St., Stamford, Conn. Published by the Quinn-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Secretary and Treasurer. Publication office, 13 West Church Street, Washington, N. J. Subscription price: U. S., $5.00; Canada, $5.00 per year, 50 cents per copy; Foreign, $7.50 per year. Entered as second class mail at the Post Office, Washington, N. J., under Act of March, 1879.

REELS and drums are built to last. Reels are sturdy at the hub, and engineered with shock absorbing characteristics to withstand side stress. Write for interesting data and prices.

Manufactured under license arrangements with Western Electric Company, Incorporated

THE STEVENS METAL PRODUCTS CO.,
NILES, OHIO



DRAW MANY SHAPES IN MANY METALS—with FIRTHALOY

The good results you have had with FIRTHALOY in drawing standard shapes can be duplicated on your intricate, **special shapes.** Use it there for better output. You can depend on its accuracy and endurance.

FIRTHALOY Sintered Carbide is available in special types to fit each requirement. And experienced FIRTHALOY engineers can apply it directly to your needs.

FIRTHALOY Shape Dies are used for drawing shaped rod, wire and tubing. These Dies may be rough cored, rough drilled, or finished in solid or sectional nibs.

FIRTH-STERLING FIRTHALOY QUALITY

Speed the War Effort by using **FIRTHALOY** everywhere possible. It's the standard carbide of the drawing industry.

FIRTH-STERLING STEEL COMPANY

Offices: McKEESPORT, PA. NEW YORK · HARTFORD · PHILADELPHIA · CLEVELAND · DAYTON · DETROIT · CHICAGO · LOS ANGELES

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING --- ROLLING --- EXTRUDING --- FORMING --- FABRICATING

Vol. 17 MAY, 1942 No. 5

Hot Dip Tinning of Carbon Steels As Affected By Variation of Carbon, Phosphorous, Copper, Silicon, Manganese, Aluminum and Titanium

By Morris E. Fine[1] and Ralph L. Dowdell[2]

(Published in Three Parts)

PART I

Abstract

A series of 63 steels of different chemical analyses were tinned and the resulting tin coating was tested to determine the appearance and smoothness of the tin coating, appearance of polished sections under high magnification, thickness of the iron-tin compound layer, thickness of the tin layer, and continuity of the tin coating. All the steels tinned satisfactorily, only small differences in properties of the coating being noticed. It was found, however, that high silicon probably caused a slightly rougher coating and that either high silicon or high manganese tended to increase the thickness of the iron-tin alloy layer. Otherwise no other correlations between composition of the steel and properties of the tin coating were found. ✦ ✦ ✦ ✦

Introduction

BECAUSE of a definite lack of information concerning the influence of the composition of the base plate on the properties of the tin coating produced by hot tinning, this investigation was undertaken. This lack of information is partly caused by the fact that all mild steels, regardless of composition, can be tinned. It was thought, however, that small variations in carbon, phosphorus, manganese, copper, silicon, aluminum, and titanium which are encountered in different heats of steel might influence the thickness of the tin coating, the thickness of the tin-iron compound layer, and the continuity of the coating.

✦ ✦ ✦

IN the hot tinning of steel, previously formed articles are coated with tin by merely dipping in molten tin. The procedure varies with different plants but generally will be as follows: The parts are first pickled in acid (hydrochloric, sulfuric, and nitric acids are used), washed, and then dipped in a kettle of molten tin (590-625°F) called the roughing kettle. The roughing kettle is divided into two parts by a partition extending several inches into the tin. The tin in one part is covered by a molten flux, generally zinc chloride, ammonium chloride, or mixtures of both, and in the other part the tin is uncovered. The steel article is put in the roughing kettle in that part of the kettle covered with flux and pulled out thru the uncovered tin. The rough tinned article is then soaked in tallow or palm oil at 475-500°F. which removes much of the tin. After the soaking kettle the article is finally tinned in another kettle of molten tin called the finishing kettle at 510-560°F. This carries a cover of molten tallow or palm oil. The tinned article is then quenched with kerosene or cooled until solid on a warm "listing plate" which catches the tin drippings. After tinning the articles

1. Research Fellow. Abstract of thesis presented in partial fulfillment of requirements for the M.S. degree, University of Minnesota, 1942.

2. Professor of Metallography, University of Minnesota.

Table I — Data Concerning Making of Heats

Heat	Action in Molds	Ingot Tops	Remarks
2959	Poured fast settled quietly, 3 boils 2″ to 4″ high	Mostly flat thin crusts	Aluminum Killed
1071	Poured well, laid even and quiet	Smooth	Aluminum Killed
1083	Poured well, no boils, settled only slightly, looked as if Al. killed rather than Si. killed	Slightly rough crust	Silicon Killed
1889	Dropped about 1″ after rimming 4″— then ingots rose		Added too much Al in 5 molds — Ingots did not rim — added NaF —In last 10 cut Al— Rimmed nicely Rimming Steel
2913	Poured well, no boils settled slightly—very little action in special molds	Flat thin crust	Silicon Killed
1082	Poured well, laid even, settled quietly, well killed	Flat, smooth	Silicon killed Dephosphorized
2311	Poured well until block head lost on 43rd ingot. 43 dropped 3″ in mold then rimmed in slowly. Last 24 were capped too late causing them to rise in middle	1st 25 good, Rest had 1″ to 3″ boils	Rimming Steel — Out of 49 ingots. Last seven discarded
2774	Rimmed good for 4″ then capped — Level dropped 1″	Good, Rimmed	Rimmed heat
3626	All poured fast Laid good	Flat Crusty	Aluminum killed addition of Cn caused ingots to boil badly— FeSi and FeP laid good
1029	Poured good, laid even, no action	Smooth	Silicon killed Rephosphorized
1833	Laid good	Good	Silicon killed Resulfurized
2178	Heat Poured Slow Nozzle had slightly rough crusts	Flat thin crusts	Aluminum-Silicon killed
2821	6 - 2″-3″ boils	Rough	Aluminum killed Rephosphorized high copper and high phosphorous heat
1917			Rimming Heat Ladle held 5 minutes before 1st ingot teemed. Did not use any NaOH

are cleaned to remove the grease left on the coating by wiping in bran, sawdust, or chalk or by dipping in some alkaline cleaner. The thickness of the coating can be controlled somewhat by the temperatures of each kettle and the length of the time the article is immersed in the tin.

✦ ✦ ✦

THE manufacturing of tin-plate in tinning machines at the steel mills is very similar to this except the sheets upon emerging from the machine pass thru a set of rolls which remove the excess tin. Therefore, any conclusions obtained in this investigation should be applicable to the manufacture of tin plate.

✦ ✦ ✦

II. Previous Work

AS far as the authors know there is no published report of any investigation seeking to correlate the properties of the tin coating and the composition of the steel base. It has been claimed that the use of rimming steel because of the absence of non-metallic inclusions in the surface of the steel results in lessening of blisters and pin holes.[1]

✦ ✦ ✦

SANDELIN[2] studied the influence of composition of the base steel upon the properties of hot dipped zinc coatings. He concluded that appreciable silicon in the steel caused the zinc coating to be dull gray consisting entirely of iron-zinc alloys. Other elements were also found to markedly influence the appearance, adherence, thickness, and microstructure of the zinc coating. This, **Sandelin** claimed, was due to changes of the diffusion rate of iron into the zinc with changes of composition of the steel.

✦ ✦ ✦

ATTEMPTS, however, have been made to correlate the corrosion resistance of tin cans with the composition of the steel base. Since the tin-plate, on steel is not continuous, and since it is made more discontinuous by the bending and stamping operations in the manufacture of tin cans, corrosion resistance of the steel base is a defin-

[1]All references will be published at the end of the article.

ite factor in the service life of a tin can. This is especially true in media in which the tin is cathodic to the iron.

✦ ✦ ✦

THE first report of an investigation on correlation between steel composition and tin can life was made in 1923 by a committee representing the **National Canners Association, American Can Co.** and **Titanium Alloy Manufacturing Co.**[3] The committee concluded that (1) both the use of titanium as a ladle addition and increased thickness of coating increase the resistance of tin plate to perforation. (2) There is no justification for addition of copper or specification for its absence. (3) Silicon causes a decrease in resistance to perforation. (4) Resistance to perforation is influenced by furnace practice, chemical composition of the steel with special reference to the content and segregation of phosphorus and sulfur, and other factors, and (5) discoloration of the can by the food contained in it is not influenced by the steel base or weight of tin coating. Manganese was also found to be detrimental.

✦ ✦ ✦

IN 1939 **Hoar, Morris, and Adams**[4] published a report of an investigation of the influence of steel base composition on the rate of hydrogen swell formation in tin cans. According to their results high copper (0.16 - 0.22 per cent) and low phosphorus (0.3 - 0.045 per cent) are desirable. In enameled cans phosphorus was found to be detrimental in certain cases while 0.2 per cent copper was found to be helpful in reducing the corrosion rate in certain solutions but had no effect in other solutions. Sulfur was found to have no influence.

✦ ✦ ✦

STILL more recently **R. R. Hartwell**[5] investigated the influence of steel base composition on the can service life of tin-plate containers. He investigated container life in acid food products and his results indicated that: (1) Increasing phosphorus in the steel base results in rapidly decreasing corrosion resistance of enameled cans. An increase in phosphorus from 0.015 to 0.045 per cent reduced the corrosion resistance to one-half or one-third. In plain cans, phosphorus has less influence, but a low phosphorus steel base tends to have a better corrosion resistance. (2) In enameled cans increasing copper either increases or decreases the corrosion resistance depending on the food in the can, but in general low

Table I-B — Chemical Composition of the Fifteen Heats Used in Making the Samples

Heat No.	C	P	S	Mn	Cu	Si
2774	.04	.009	.021	.27	.190	.007
2283	.08	.011	.021	.32	.170	
1917	.05	.010	.020	.30	.174	.002
2311	.08	.008	.022	.27	.198	
1889	.07	.011	.019	.37	.227	.001
1071	.10	.011	.024	.44	.310	.0094
2959	.11	.015	.028	.42	.175	.0090
2821	.10	.057	.028	.39	.387	.005
1083	.10	.010	.020	.43	.216	.270
2178	.05	.011	.026	.45	.229	.120
1029	.10	.099	.035	.39	.292	.200
3626	.17	.019	.032	.48	.235	.015
1833	.19	.018	.075	.90	.200	.121
2913	.32	.017	.027	.50	.191	.127
1082	.10	.077	.027	.44	.302	.292

Mold additions were made to heats 1071, 2959, 2178, 3626, 2913, and 1029. The composition of the resulting ingots are given in Table II.

The range of composition covered by the sample steels are given in Table III.

Table II — Chemical Compositions of Ingots Made by Mold Additions

Heat No.	Sample	C	P	S	Mn	Cu	Si	Al	Ti
1029	1	.10	.099	.035	.39	.292	.200		
1029	2	.10	.099	.035	.39	.292	.500		
1071	12	.10	.011	.024	.44	.310	.0094		
	Base Comp.								
1071	1	.10	.011	.024	.44	.310	.214		
1071	4	.10	.087	.024	.44	.310	.0094		
1071	5	.10	.011	.024	.44	.652	.0094		
1071	6	.10	.011	.024	.44	.590	.173		
1071	7	.10	.011	.024	.44	.622	.0094		
1071	8	.10	.067	.024	.44	.452	.196		
1071	9	.10	.011	.024	.44	.503	.181		
1071	10	.10	.066	.024	.44	.484	.0094		
1071	11	.10	.079	.024	.44	.759	.0094		
1071	13	.10	.079	.024	.44	.310	.187		
1071	14	.10	.067	.024	.44	.310	.0094		
2178	8	.05	.011	.026	.45	.229	.120	trace	.000
	Base Comp.								
2178	1	.20	.011	.026	.45	.229	.120		
2178	2	.35	.011	.026	.45	.229	.120		
2178	3	.05	.011	.026	.45	.229	.120		.042
2178	4	.05	.011	.026	.45	.229	.120		.100
2178	5	.05	.011	.026	.45	.229	.120		.169
2178	6	.05	.011	.026	.45	.229	.120	.145	
2178	7	.05	.011	.026	.45	.229	.120	.303	
2913	10	.32	.017	.027	.50	.191	.127		
	Base Comp.								
2913	1	.32	.017	.027	.50	.358	.127		
2913	2	.32	.017	.027	.50	.600	.127		
2913	3	.32	.017	.027	.50	.191	.248		
2913	4	.32	.017	.027	.50	.191	.357		
2913	5	.32	.017	.027	.50	.191	.625		
2913	6	.32	.017	.027	.69	.191	.127		
2913	7	.32	.017	.027	.89	.191	.127		
2913	8	.32	.040	.027	.50	.191	.127		
2913	9	.32	.080	.027	.50	.191	.127		
2959	12	.11	.015	.028	.42	.175	.0090		

(Continuation of Table II on Following Page)

Table II — Chemical Compositions of Ingots Made by Mold Additions

(Continued From Previous Page)

Heat No.	Sample	C	P	S	Mn	Cu	Si	Al	Ti
	Base Comp.								
2959	1	.11	.070	.028	.42	.175	.009		
2959	2	.11	.015	.028	.42	.289	.009		
2959	3	.11	.015	.028	.42	.470	.009		
2959	4	.11	.015	.028	.42	.175	.412		
2959	5	.11	.015	.028	.42	.400	.436		
2959	7	.11	.086	.028	.42	.175	.570		
2959	8	.11	.060	.028	.42	.470	.009		
2959	9	.11	.080	.028	.42	.377	.568		
2959	10	.11	.033	.028	.42	.175	.009		
2959	11	.11	.070	.028	.42	.475	.560		
3626	10	.17	.019	.032	.48	.235	.015		
	Base Comp.								
3626	1	.17	.019	.032	.48	.388	.015		
3626	2	.17	.019	.032	.48	.676	.015		
3626	3	.17	.019	.032	.48	.235	.132		
3626	4	.17	.019	.032	.48	.235	.249		
3626	5	.17	.019	.032	.48	.235	.508		
3626	6	.17	.019	.032	.73	.235	.015		
3626	7	.17	.019	.032	.85	.235	.015		
3626	8	.17	.045	.032	.48	.235	.015		
3626	9	.17	.084	.032	.48	.235	.015		

Table IV — Hardness of Each Billet Using Rockwell B Scale *

A — Rimming Steels

Heat No.	Hardness Rockwell B	Chemical Composition C	P	S	Mn	Cu	Si
1917	51	.05	.010	.020	.30	.174	.002
1889	55	.07	.011	.019	.37	.227	.001
2283	53	.08	.011	.021	.32	.170	
2311	54	.08	.008	.022	.27	.198	
2774	55	.04	.009	.021	.27	.190	

B — Individual Heats

Heat No.	Hardness Rockwell B	Chemical Composition C	P	S	Mn	Cu	Si
1082	71	.10	.077	.027	.44	.302	.292
1083	63	.10	.010	.020	.43	.216	.270
1833	72	.19	.018	.075	.90	.200	.121
2821	58	.10	.057	.028	.39	.387	.005

1082 is a silicon killed-rephosphorized heat
1083 is a silicon killed steel
1833 is a silicon killed resulfurized steel
2821 is an aluminum killed rephosphorized steel

C — Rephosphorized Silicon Killed Steel with Varying Silicon — Heat #1029

Spec No.	Hardness Rockwell B	Chemical Composition C	P	S	Mn	Cu	Si
1029-1	69	.10	.099	.035	.39	.292	.200
1029-2	75	.10	.099	.035	.39	.292	.500

* The values given are an average of three readings taken at the center of the billet. At no time did any of the readings differ by more than 1 division on the scale. The difference in hardness between the edge and center did not differ by more than 1 division either.

phosphorus and low copper are desirable. (3) No correlation was obtained between the can life and carbon, sulfur, or manganese content of the steel base. (4) There is some indication that large amounts of nickel and chromium are detrimental. (5) Silicon in steels with high phosphorus is frequently associated with short service life. According to Hartwell, silicon had a larger effect on the corrosion resistance than any other element. This was partly due to the formation of small cracks in the surface of the tin plate with high silicon which was produced when the sheet was formed into cans. These were found to extend into the steel base, and frequently carbide segregations were found by these cracks. **Rocquet**[6] noticed inter-crystalline corrosion in certain silicon killed steels, and these caused flux inclusions in the tin coating. Rocquet claimed regulated pickling could eliminate this.

✦ ✦ ✦

IN none of these investigations has any attempt been made to correlate properties of the tin coating with composition of the steel. The above results are influenced by the corrosion resistance of the steel itself because of the presence of discontinuities in the tin coating. It is impossible to draw any conclusions as to how the continuity varies with composition since the corrosion resistance of the steel will itself vary with composition. The composition of the steel, the deoxidizer used, and the deoxidization practice influence the cleanliness of the steel and might conceivably influence the number of discontinuities in the tin coating

Table III — Range of Composition Covered by the Sample Steels.

Element	Range of Chemical Composition per cent
Carbon	0.04 - 0.35
Phosphorus	0.008 - 0.099
Sulphur (not varied)	0.019 - 0.075
Manganese	0.27 - 0.89
Copper	0.170 - 0.759
Silicon	0.001 - 0.625
Aluminum*	trace - 0.303
Titanium*	trace - 0.169

* Only analyzed in Heat No. 2178.

(pin-holes). Since the rate of diffusion of the tin into the steel or iron into tin depends most likely upon the composition of the steel, it would be expected that the composition of the steel would have an important influence upon any iron-tin alloying action.

✦ ✦ ✦

III. Description of Steels Used And Preparation of the Tinned Samples of Each Steel

1. Description of Steels

FOR this investigation 63 steels having different compositions made from 15 different open hearth heats were obtained from the **Atlantic Steel Company.** These steels had been prepared by **R. W. Sandelin**[7] for his investigation of the galvanizing characteristics of different steels. Fifty-four of these were obtained by making mold additions to six different heats of steel.

✦ ✦ ✦

SANDELIN decided upon the procedure of making additions to the ingot mold to make a series of steels in which the desired element only was varied and all other elements held constant. Of the nine remaining steels, all were from individual heats, five of which were made by rimming practice. The mold additions were of either ferro-alloys or the pure metals and were added to the ingot molds as the heat was being poured. Silicon was added as 50 per cent ferrosilicon, manganese as 80 per cent ferro - manganese, phosphorus as 24 per cent ferro-phosphorus, titanium as 20 per cent ferro-titanium, aluminum as pig aluminum, copper as pure copper, and carbon as granular graphite. The heats were cast into 4000 pound ingots which were rolled into 1-½ inch billets. The samples used were cut from that part of the billet from the middle of the ingot. **Sandelin** tried using 1¾ inch x 18 inch gage hot-rolled strip for his samples, but these proved unsatisfactory due to variations in rolling conditions. For his investigation Sandelin used surface ground samples cut from these 1½ inch billets.

D Aluminum Killed Steel with Variation in Silicon, Phosphorus, and Copper, Heat #1071

Base Composition	C	P	S	Mn	Cu	Si
#12	.10	.011	.024	.44	.310	.0094

Spec No.	Hardness Rockwell B	Chemical Composition Si	P	Cu
12	60	.0094		
1	64	.214		
12	60		.011	
14	63		.067	
4	69		.087	
12	60			.310
7	64			.622
5	65			.652
12	60	.0094	.011	.310
6	66	.173	.011	.590
9	75	.181	.011	.503
13	72	.187	.079	.310
10	69	.0094	.066	.484
11	69	.0094	.079	.759
8	68	.196	.067	.452

E Aluminum Silicon Killed Steel with Variation in Carbon, Aluminum, and Titanium, Heat #2178

Base Composition	C	P	S	Mn	Cu	Si	Al	Ti
#8	.05	.011	.026	.45	.229	.120	Trace	.000

Spec No.	Hardness Rockwell B	Chemical Composition C	Al	Ti
8	58	.05		
1	68	.20		
2	75	.35		
8	58		Trace	
6	56		.145	
7	57		.303	
8	58			.000
3	62			.042
4	67			.100
5	75			.169

F Silicon Killed Steel with Variation in Phosphorus, Manganese, Copper, and Silicon, Heat #2913

Base Composition	C	P	S	Mn	Cu	Si
#10	.32	.017	.027	.50	.191	.127

Spec No.	Hardness Rockwell B	Chemical Composition P	Mn	Cu	Si
10	80	.017			
8	82	.040			
9	79	.080			
10	80		.50		
6	85		.69		
7	82		.89		
10	80				.127
3	82				.248
4	81				.357
5	80				.625
10	80			.191	
1	80			.358	
2	79			.600	

G Aluminum Killed Steel with Variation in Phosphorus, Manganese, Copper, and Silicon, Heat #3626

Base Composition	C	P	S	Mn	Cu	Si
#10	.17	.019	.032	.48	.235	.015

Spec No.	Hardness Rockwell B	Chemical Composition P	Mn	Cu	Si
10	64			.235	
1	69			.388	
2	66			.676	
10	64				.015
3	72				.132
4	67				.249
5	66				.508
10	64		.48		
6	76		.73		
7	65		.85		
10	64	.019			
8	69	.045			
9	68	.084			

H Aluminum Killed Steel Variation in Copper, Phosphorus, and Silicon, Heat #2959

Base Composition	C	P	S	Mn	Cu	Si
#12	.11	.015	.028	.42	.175	.009

Spec No.	Hardness Rockwell B	Chemical Composition P	Cu	Si
12	59	.015		
10	62	.033		
1	64	.070		
12	59		.175	
2	58		.289	
3	62		.470	
12	59			.009
4	68			.412
12	59	.015	.175	.009
5	70	.015	.400	.436
7	73	.086	.175	.570
8	65	.060	.470	.009
9	75	.080	.377	.568
11	75	.070	.475	.560

Table V — Size Limits to Which Specimens Were Ground

	Width	Thickness
Set #1	1.42″ - 1.46″	.406″ - .410″
Set #2	1.42″ - 1.46″	.390″ - .410″
Set #3	1.42″ - 1.46″	.396″ - .410″
Set #4	1.42″ - 1.46″	.398″ - .419″

SOME of the data concerning the teeming of these 15 heats are given in Table I. The analysis of the fiteen heats without any additions are given in Table 1B. All chemical analyses were made by the **Atlantic Steel Company** on drillings obtained from billet samples.

✦ ✦ ✦

THE hardness of each billet on the Rockwell B scale is given on Table IV. It will be noticed from the data presented in Table IV that in general as the carbon, silicon, phosphorus, manganese, copper, and titanium are increased the hardness increases. Aluminum does not seem to have much effect. In higher carbon steels (Table IV-F - Heat #2913) the effect of other elements is not so noticeable. In this series which has 0.32 per cent carbon, and in the series from heat #3626 which has 0.17 per cent carbon, as the silicon, phosphorus, manganese, and copper increase above the base value, the hardness at first increases and then decreases slightly. In comparing these values it is assumed that all other conditions such as rolling temperatures, rate of cooling, and ingot conditions were constants. Of course this is not true.

✦ ✦ ✦

2. Preparation of Tinned Samples

ONE small billet of each analysis was obtained from the **Atlantic Steel Company.** These billets were about 1½ inches square and varied from 5¾ inches to 6¼ inches long. Four specimens ½ inch wide were sawed from the end of each billet. The samples were cut this way so that any difference in the properties of the tinplate at the center and at the edge of the billet could be determined. This resulted in four complete sets of 63 samples. A hole 9/16 inch in diameter was drilled in each specimen ¼ inch from two edges (Fig. 2), and then all six surfaces were surface ground. Several spare samples were tinned, but the surface of the tin was rough due to grinding marks on the steel; therefore, the specimens were further polished on a wet belt polishing machine with a 150 mesh carborundum belt. The surface produced from this did not make the tin plate rough. The variation in dimensions between samples in the same set are given in Table V.

✦ ✦ ✦

TO make tinning conditions constant each set of samples (63 in a set) were mounted in a specially constructed rack (Fig. 1), which consisted of a steel frame supporting 3 sections of ¼ inch rod. The specimens were strung on the rod through the holes which were drilled in one corner and separated from adjoining specimens by washers (Fig. 1). The specimens hung loosely on the rods.

(*Please turn to Page 256*)

"THE MACHINES THAT PUT THE 'RINGS' IN SPRINGS"

30-150
SPRINGS
per minute
(according to drive)

No. 1½

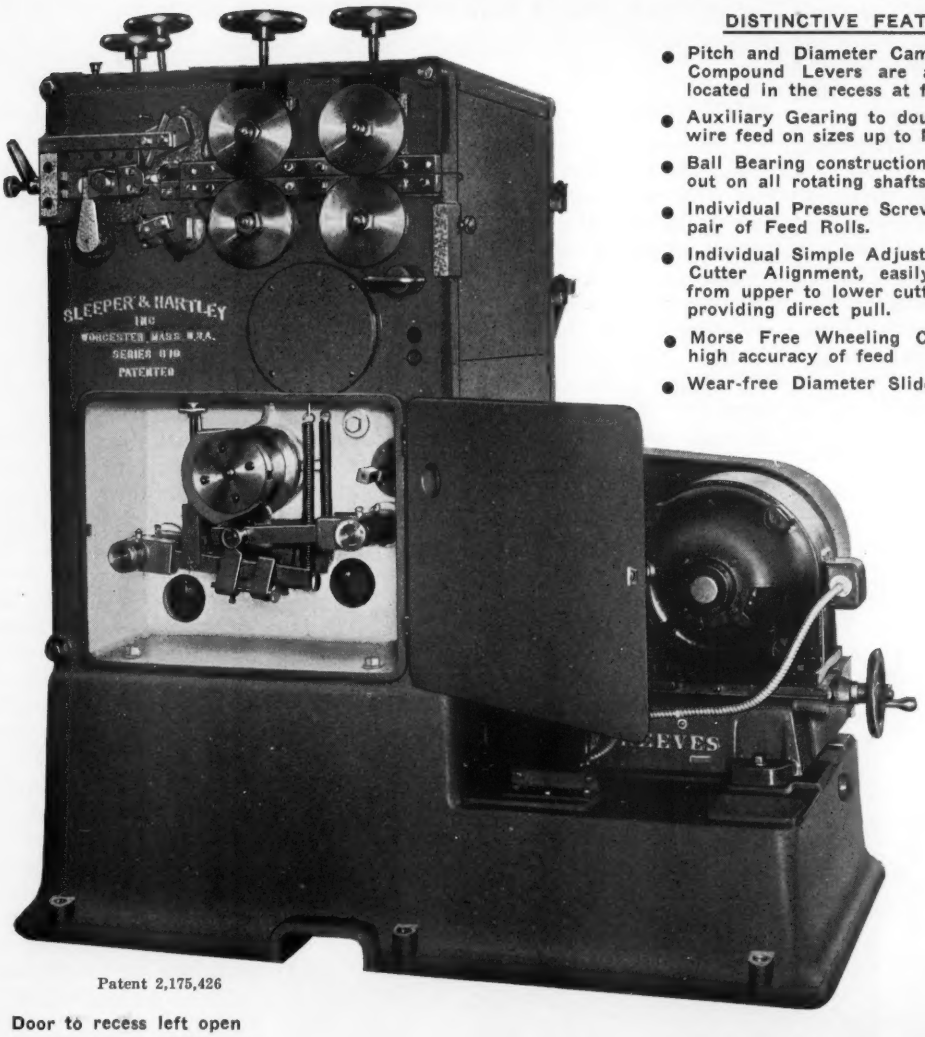
Universal Spring Coiler

30-150
SPRINGS
per minute
(according to drive)

SEGMENT TYPE

56" Model - Series 676

Wire Sizes No. 20 (.031") to No. 11 (.120")



Patent 2,175,426

Door to recess left open to show accessibility to Cam Controls, Compound Blocks and Cams.

A ratchet crankhandle, used for set-up purposes, is removable.

DISTINCTIVE FEATURES

- Pitch and Diameter Cams and Compound Levers are accessibly located in the recess at front.
- Auxiliary Gearing to double the wire feed on sizes up to No. 15 (.072")
- Ball Bearing construction throughout on all rotating shafts.
- Individual Pressure Screw on each pair of Feed Rolls.
- Individual Simple Adjustment for Cutter Alignment, easily adjusted from upper to lower cutter thereby providing direct pull.
- Morse Free Wheeling Clutch for high accuracy of feed
- Wear-free Diameter Slide Connection

SLEEPER & HARTLEY, Inc.

DESIGNERS AND BUILDERS

WORCESTER, MASSACHUSETTS, U. S. A.

A New Metal Coating Process

By Major A. E. Bellis
President,
The Bellis Heat Treating Co., Branford, Conn.

THIS paper introduces a new process to the wire industry. It has not been previously published and because of patent considerations, the disclosures herein could not have been published before this month. For anyone to tell the wire industry, or any branch of the steel or metal industries that there is any new process, is presumptuous, in the extreme. The saying, "Fools rush in where angels fear to tread" immediately classifies the individual who trys to tell the metallurgical fraternity what is new about metals. With this brief introduction, as the toastmasters say, I hasten to give the title of this paper and of the process introduced: **"A New Metal Coating Process"** or how to cover wire with tin or tin alloys.

✦ ✦ ✦

IN order to make it clear that this is new, it will be necessary to show how this process was developed only after other hot metal-joining and coating processes have been invented and commercially tested and established in production, laying the foundation for the necessary chemical, physical, and economic steps on which the new process depends.

✦ ✦ ✦

IT might be well to explain that the process being introduced is that of preheating and fluxing for tinning (or other metal coating) in a salt bath of special characteristics. These special characteristics are a reducing or fluxing effect equal to the hydrogen of a cold acid in a stable bath (non-fuming and non - deteriorating) through a wide temperature range from the low melting point of the salt bath to temperatures equal to or above that of the hot coating metal. Because the bath material itself is new, the application to wire tinning is in itself no great innovation. However, associated with the new bath material, it becomes a new method of heating the bath and of heating the coating metal.

✦ ✦ ✦

PREVIOUSLY, preheating the wire has been unsuccessful because the acid-fluxing bath would cool the wire and the hot wire would destroy the acid - evolving fumes. Fluxing the wire and then heating it has likewise been unsatisfactory, as, of course, the heat evaporates the fluxing acid and destroys the surface of the wire. Obviously, a fluxing bath stable through the preheating range through which the wire can be drawn and from which it can pass directly into the molten tin, is the ideal arrangement. It helps one to visualize the process to think of a trough of mercury on which water is floated. A strand passing first through the water and then into the mercury would be like the wire passing from the fluxing bath through the tin, except that the latter system would be several hundred degrees hotter.

✦ ✦ ✦

ACTUALLY, the coating metal can be submerged in a small **"Laver"** or pot in the heated-fluxing salt bath with a considerable saving of the coating metal.

✦ ✦ ✦

SEVERAL units for hot dip coating with non-ferrous metals such as zinc, babbitt, solder, cadmium, tin and tin alloys, use the new bath for fluxing the steel previous to immersing it in the molten coating metal. In other words, the new fluxing bath is used as a preheat.

✦ ✦ ✦

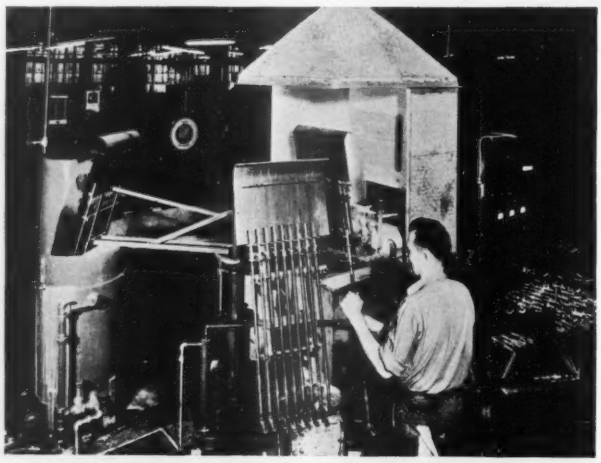
IT is important that the work remain in the new flux bath a sufficient time to heat through thoroughly; since the bath freezes around the work when it is immersed, and must completely melt away from the work to give the required fluxing action. The use of this new bath as a flux, of course, eliminates the use of acid.

✦ ✦ ✦

THE setup recommended consists of a pot of the fluxing bath heated electrically and internally by the use of electrodes. In one section, the pot of coating metal is immersed; since practically all of the work of heating will be done in the new fluxing bath preheating operation; the coating bath requires only enough heat to maintain temperature absorbed through the walls of the container, and in this way, the heat maintained in the coating bath will be very uniform.

✦ ✦ ✦

IN general, the new process used for preheat takes the place of an equivalent volume of coating metal. Taking tins in



Dip Brazing Furnace operating at 1650° F. using Fluxing Bath of 1300° F. melting point.

✦ ✦ ✦ ✦ ✦

comparison with the new bath, there is a difference in the cost of about $175.00 per cubic foot in favor of the new fluxing bath, so that the saving in investment will approach one thousand dollars for any moderate-sized setup, and may involve many thousands of dollars in any large production unit.

✦ ✦ ✦

SUCH a setup will immediately eliminate all of the well-known difficulties of externally heating pots of molten metal, as of old, where the scale and dross on the pot wall retard the heat transfer, causing hot spots and making close temperature regulation difficult.

✦ ✦ ✦

BRIEFLY, the new fluxing bath for tin coating as applied to refrigerator parts, bearing metals, continuous wire and strip, is carried out in three Bellis' Furnaces and two solution tanks arranged in the following sequence. (See sketch shown above).

I. Tank of 15% solution of Number 40 Coating (new fluxing) Bath and water.

II. Furnace fused with Number 40 (new flux) Bath at temperatures of 500-900°F. The higher temperatures expedite production. These shorten the time, which depends on the size of the pieces.

III. Furnace with the tinning or galvanizing kettle of proper size to immerse work is maintained at 540°F. by heat transmitted through the new fluxing bath surrounding the sides and bottom of the pot. The Bath is heated by electric currents conducted into it by immersed electrodes.

IV. (In some rough tinning this and the following steps are omitted). Where the finishing tin pot is used, the parts are quenched into a tank which becomes a concentrated solution of the new process after continuous use and overflows into Tank Number I. The water loss from evaporation is added to this tank, so water inlet is provided.

V. Finishing tin pot is the same as Numerical III, and is best operated at 480°F.

✦ ✦ ✦

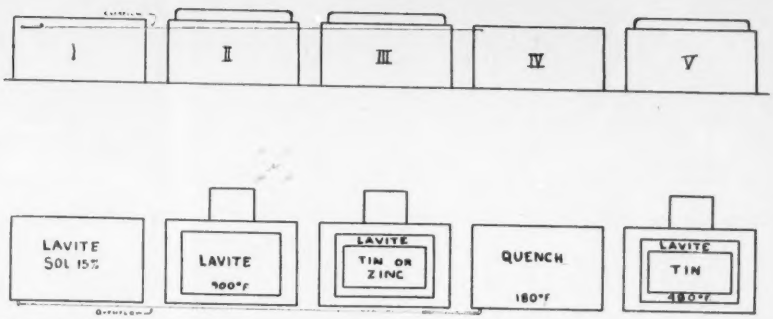
THE advantage of the two dips is that it is very difficult to maintain the conditions set up in III, above so that absolutely no dross sticks to the work or no corners or no part of the work is uncovered with tin. After the dip in III the work to be done by (V), Second Bath, is quick and entirely satisfactory; and the maintenance of this second tin bath to a high degree of purity is a simple matter.

✦ ✦ ✦

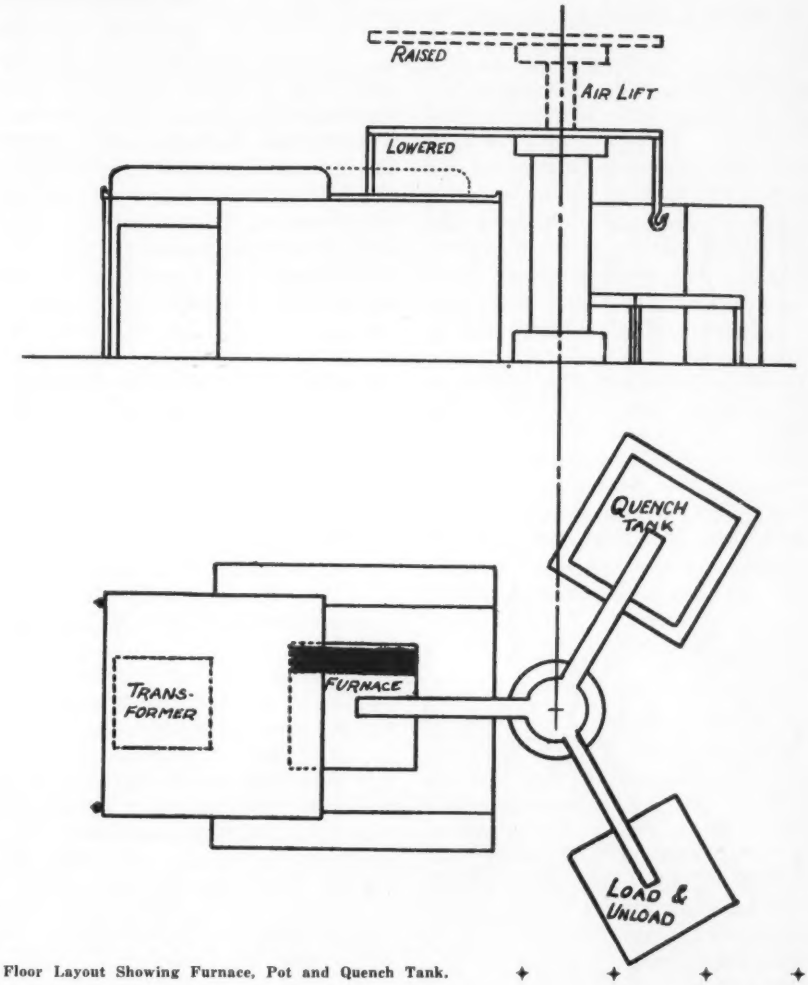
THE evolution of this process from previous hot metal joining and coating processes can be best explained by first describing how copper brazing of steel parts was developed.

✦ ✦ ✦

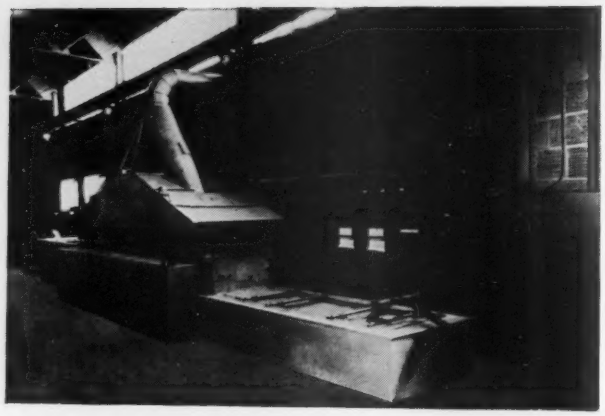
THE furnace shown in the picture and drawing gave a dip-brazing process because of the fluxing effect of the bath with 1300F. melting point. The benefits of this new technique are: one



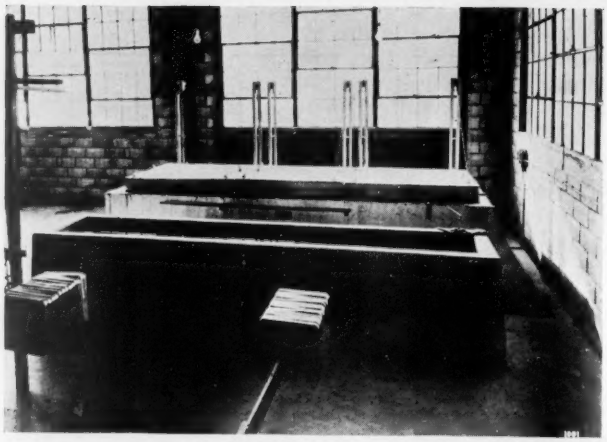
Sketch Showing Arrangement of Furnaces and Solution Tanks.



Floor Layout Showing Furnace, Pot and Quench Tank.



Strand Salt Bath Metal Coating Installation.



Batch Type Furnace with Pot 16" long which operates at temperatures of 300° to 1200° F.

new-fluxing Bath can take the place of several chambers and vestibules; the equipment is rugged, simple, and inexpensive. No special refractories or heating elements or gas-tight chambers are necessary. There is no explosion hazard. The atmosphere or fluxing bath is constant in composition and neutral to parts brazed, and to brazing alloys; no flux need be added. Time cycles are greatly lessened, minutes against hours. The furnace works at a constant, exact temperature. No cooling cycle or "over-heat" is necessary. Furnace does not have to be reheated after each load. No conveyor belts or rollers are necessary. Light racks have no wear and tear, and absorb very little heat. No chrome oxide forms, therefore, chrome alloys can be brazed. No decarb or annealing need occur; as parts may be quickly quenched or slowly cooled as required with the protective coating of the new fluxing Bath, preventing oxidation or scaling of the work and distortion of parts. No deposits of carbon are possible. Copper Zinc alloys, which often have stronger joints and lower brazing temperatures, can be used without the difficulties of the longer heating cycle, causing deterioration of the alloy from volatility of the zinc.

✦ ✦ ✦

VERY briefly stated, the salt bath furnace eliminates the atmosphere problem with all its troubles and hazards; since brazing becomes a short operation, eliminating decarb and corrective heat-treating. This furnace has been highly developed in the last ten years for hardening high-speed steel at 2300F. and production annealing of ton lots of metal at 1000F to 2000F. This experience has solved the problems of heating large salt baths to high temperatures economically. An interesting step, after the copper brazing was perfected, was the use of the copper zinc alloys with melting temperatures down to 1650F for the joining metal. This avoided heating the steel to the excessive temperatures used for copper brazing. By properly regulating the cooling, as by interrupting the quenching in another salt bath, it was possible to heat treat the steel to the desired physical properties. The next step in evolving this process was the joining of steel tubes with the silver brazing alloys for temperature range of 1000 to 1400F. This was carried out by preheating in the same bath as was used for the copper brazing.

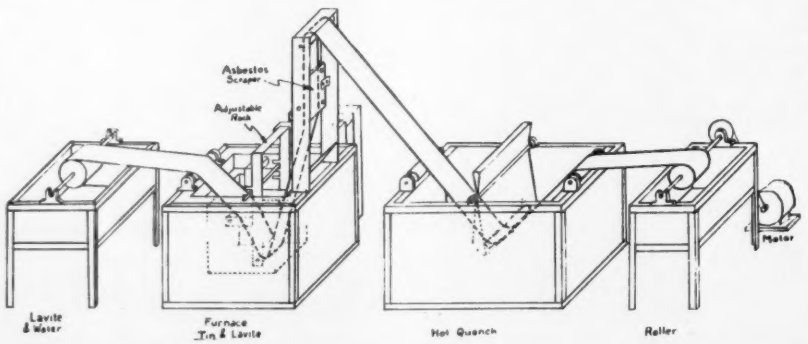
✦ ✦ ✦

BEARING parts have been coated with cadmium nickel silver alloys. Here, the parts are preheated in the fluxing bath, then dipped into the hot fused alloy under a film of the fluxing-bath material. They are then dipped into the preheat to strip off the excess alloy. This last step salvages the heat from the metal dipping bath; so very little heat is required that the actual data is astonishing, and furthermore exceptionally good pot life results.

✦ ✦ ✦

A FURTHER consideration of this heat-saving step is important. Such an alloy is a very good conductor of heat and gives up heat very rapidly to a metal immersed therein. The ratio of specific heats of alloy and the salt material of the bath are 0.032 to 0.21. Therefore, when the heated hot metal, after passing through the salt bath, enters the alloy bath, the heat will be very rapidly extracted from the metal. Assuming that the work is heated in the salt bath to 1570F. and the alloy has a melting point of 370F, the net loss of heat would be only 370 times the specific heat and weight of the

(*Please turn to Page 253*)



New Fluxing Bath Tinning Process.

Powder Metallurgy As A Help To National Defense

By Charles Hardy,
President,
Hardy Metallurgical Company, New York, N. Y.

Since powder metallurgy is being used in production processes for many products formerly made exclusively from tool steel or wire the study presented herewith will undoubtedly be of interest to many wire men.

DURING the last year or two there have appeared a great many articles on powder metallurgy in various technical and semi-technical papers and even in the daily press. It is therefore assumed that the name as such is familiar to the readers of "Wire and Wire Products."

✦ ✦ ✦

NOT so well known, however, is the fact that this art plays an important part in national defense. Before we discuss this contribution, however, it might be well to state a few of the fundamentals of powder metallurgy, in order that he who reads may understand.

✦ ✦ ✦

THE art had its beginning thousands of years ago and appeared in literature during the latter part of the last century, but its application and industrial development on a large scale really began only with the present century when tungsten, molybdenum, platinum, and osmium—all metals of high melting points—were reduced to metal powders from their oxides. The melting point of these metals is so high that orthodox melting practices and refractories are inapplicable, so that a far different treatment had to be found. The powders resulting from the reduction of their oxides by hydrogen or carbon were compressed, subsequently sintered to bond the individual particles, and subjected to swaging, hammering and other mechanical operations until a homogeneous dense mass was created which could thereafter be drawn to wire or rods or rolled into sheets, etc.

✦ ✦ ✦

FOR the above-mentioned metals the main reason for adopting powder metallurgical methods was the inability to melt these powders economically at such high temperatures. This article, however, intends to deal with the advantages that powder metallurgy offers in producing metal parts from metals like copper, brass, aluminum, iron and steel—metals which probably never have offered melting or working difficulties.

✦ ✦ ✦

METAL powders can be produced by many various methods, but generally the powders now used commercially on large scales are made by the following basic production processes:

1. Reduction of the metal from its source by the use of gases.
2. Electrolytic deposition.
3. Precipitation.
4. Atomization.
5. Carbonyl process.

✦ ✦ ✦

EACH of the above processes has its advantages and disadvantages for any specific metal, and in many cases the ultimate user must select the powder produced by the process which will supply those characteristics required in the finished product.

✦ ✦ ✦

IN producing metal powders, purity alone is not sufficient to give good results. Physical properties, grain structure, grain size and grain assortment play a role of greater importance, probably, than 99.9% purity. The production of a powder with the desired physical characteristics has been matter for intense study, and it is now possible, but not always economical, to meet practically any demand the ultimate user may make. Powders have been made globular or spherical, angular, dendritic, nodular, with apparent densities ranging from less than 1 to 8, and in one case actually to 16. Furthermore, particle sizes have been so controlled that a particular requirement that no particle should exceed .2 microns was met. More important than any of the above characteristics for general use, however, is the question of particle assortment, which plays an important part in deciding which type of powder suits a particular purpose, especially when the finished product is to be a solid part with predetermined porosity. It is quite frequent that the ultimate user demands 5, 10, 25% or even greater porosity, either for oil absorption or to create sufficient surfaces of the metal for catalytic purposes. It has often been stated that if one cubic inch is desired to possess two acres of surface, powder metallurgy can meet the requirement.

✦ ✦ ✦

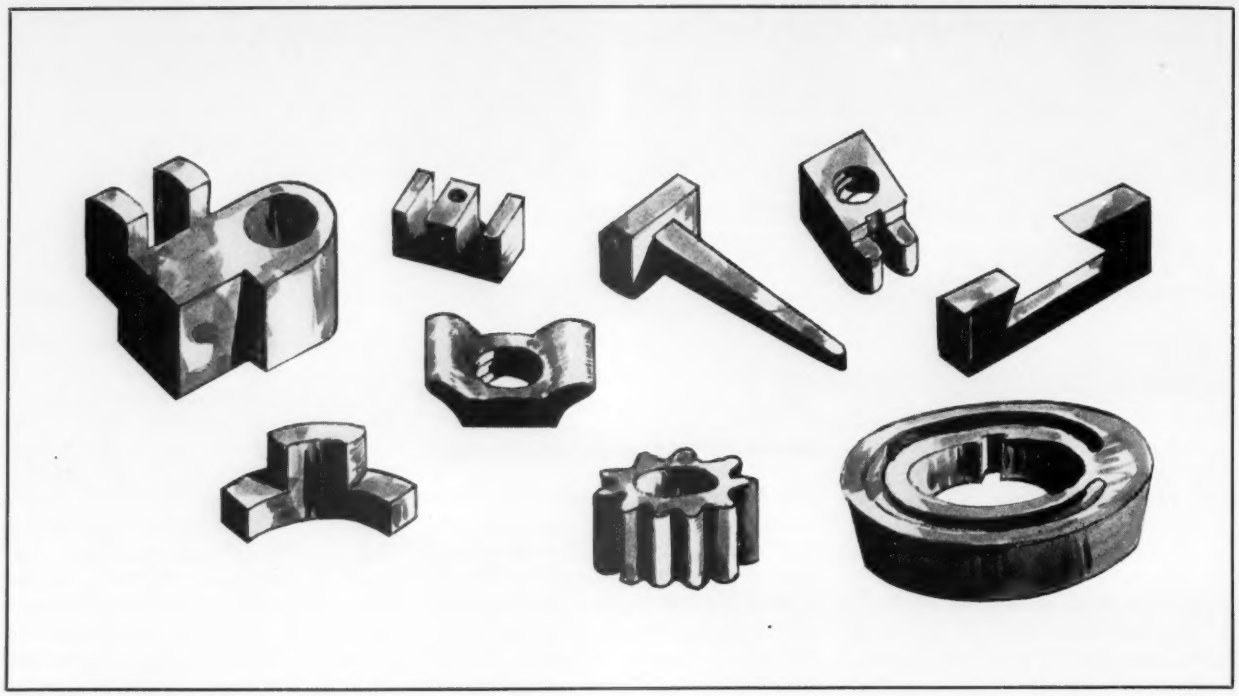
THE application of these powders proceeds as a rule by the following steps:

1. Mixing or blending, if more than one element is needed in the final product;
2. Automatic loading of powders into the dies;
3. Compression into and ejection of the compressed powders from the dies;
4. Sintering;
5. Coining.

✦ ✦ ✦

Mixing or Blending

A GREAT many parts are made from a single metal, others from a mixture of metals, others from pre-alloyed metal powders and still others from a mixture of metals with non-metals. Hence, in order to obtain a homogeneous mass with thorough distribution of metals and of the various elements, it is essential to employ a mixing operation. For instance, carbon



Some Finished Products Produced by the Powder Metallurgy Operation.

brushes represent a mixture of tungsten and carbon which are of entirely different specific gravities; hence the necessity for a thorough mixing or blending.

✦ ✦ ✦

Loading Into the Dies

THE dies are now loaded automatically. Equipment is available for uniform mass production of parts from metal powders.

✦ ✦ ✦

Compression and Ejection

METAL powders are compressed at pressures varying from a few pounds to seventy-five tons per square inch, according to the requirements of the final piece. The compression ratio varies with the density of the powder. For example, where a copper powder has an apparent density of 2.75, and close approximation to the full density of copper (8.9) is desirable, the compression ratio would have been in the neighborhood of 3.1 to 1.

✦ ✦ ✦

WHILE the compression takes place a lubricant is applied either to the die or added in powder form to the mixture, and this facilitates ejection from the die. To give an example, where forty tons are used for compression, only one or two tons pressure are needed for ejection.

✦ ✦ ✦

Sintering

SINTERING follows compression immediately, and takes place in equipment specially designed for this purpose, at temperatures which are almost invariably below melting point of the metal or alloy to be sintered. Sintering usually takes place in a special atmosphere such as hydrogen or nitrogen.

✦ ✦ ✦

Coining

COINING is a process designed to give the compressed part the final dimension specified by the ultimate user and corrects such distortions as shrinkage, growth and mal-alignment which may occur during the sintering process. The art has sufficiently advanced that tolerances of .001 inch and even closer can be guaranteed.

✦ ✦ ✦

A VERY important role in producing desired results is played by the construction of the die and the type of material used for the die. Since the process of powder metallurgy is used in mass production, dies must be constructed in such fashion and from such material that wear and tear do not force the manufacturer to continually replace them.

✦ ✦ ✦

HAVING outlined these fundamentals, we can now indicate where the advantages lie in utilizing powder metallurgy.

1. The art lends itself to mass production. Equipment exists today which allows the production of 40, 100, and 500 pieces per minute, and recently we have seen parts, though admittedly small, which were produced at the rate of 4000 per minute.

2. The parts produced can be held within very close tolerances as to dimensions and weight.

3. Density or porosity can be controlled to meet the many requirements now called for in ultimate operations.

4. Metals and non-metals or metals not by themselves miscible can be combined and compressed by this process.

5. Unusual metallic mixtures, such as tungsten-cobalt and tungsten-carbide combinations, may be treated to make materials that have physical properties very different from those obtained by melting. Thus some of the characteristics of both cobalt and tungsten are retained in the final product.

6. Manufacturing losses are very small, generally less than 1%.

7. Machining and machining waste may be eliminated. The manufacturer of parts by powder metallurgical methods has no problem of disposal of scrap metal.

(Please turn to Page 257)

Worcester Regional Meeting

THE Annual Worcester Regional Meeting of the Wire Association was held at the Hotel Bancroft, Worcester, Mass., on Friday, April 17th, 1942.

✦ ✦ ✦

THE meeting was addressed by **Mr. Harry E. Hartman**, Wire Specialist of the Office of Emergency Management immediately following the dinner and then after a short intermission **Mr. Kenneth Lewis** spoke on the subject of "Labor Relationship". This was followed by a sound color motion picture entitled "Unfinished Rainbows" which was presented through the courtesy of the Aluminum Company of America.

✦ ✦ ✦

IN Mr. Hartman's talk, he brought out the interesting fact that many heavy demands were being placed on wire mills at the present time because of the Lease-Lend program and that certain types of mills were commencing to feel the pressure, particularly wire rope mills, welding wire mills and mills producing rolled wire.

✦ ✦ ✦

HE pointed out that a very substantial portion of domestic wire requirements are now being deferred indefinitely and that it is quite possible that in the near future civilian wire requirements will experience increasing difficulty in securing rods under priority. He also pointed out that high carbon wires for military and Lend-Lease requirements would probably take every pound of capacity available and that more may be required, but that up to this time the program had not yet reached into the low carbon field.

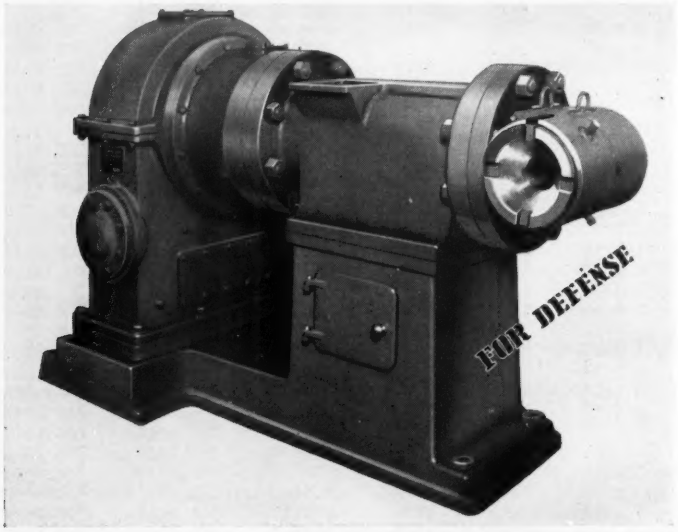
✦ ✦ ✦

MANY other topics of interest were touched upon and some discussion followed. It was all "off the record" however, but those who heard Mr. Hartman speak secured some most interesting information.

KENNETH B. LEWIS put over a splendid talk most of it also being "off the record" as he deviated very materially from his manuscript in his presentation. However, those who were fortunate enough to hear him had a number of good laughs and a lot of good sound common sense presented in a semi-humorous but soberly critical manner. Mr. Lewis is to be heartily congratulated on his very able handling of a difficult subject. His discussion will be published in the June issue of Wire & Wire Products.

✦ ✦ ✦

THE attendance was surprisingly good in view of the expressed doubts that a regional meeting could be successfully held under war conditions with something over 100 being present, representing 50 different companies.



Also manufacturers of Tubers, Strainers, Mixing Mills, Tilting Head Presses, Hydraulic Presses, Washers, Crackers, Sheeters, Refiners, Vulcanizers, Plastic Extruders, Steel Castings and Cut-Steel Gears.

6 IN. INSULATOR and EXTRUDER

for continuous insulation of wire and cable to 3½". This machine was designed to do one important rubber insulation job, but is ready to handle any size of wire from 16 Ga. to 3½" and can be converted to handle plastics with a minimum of change.

Consult with National-Erie Engineers for the Extruder that will speed your war production work.

NATIONAL-ERIE CORPORATION
ERIE, PA., U.S.A.

War Production Board Announces Changes in Steel Specifications

CHANGES in steel specifications to further the production drive and thus meet the demands of the war effort were announced today by the War Production Board.

✦ ✦ ✦

THE changes are designed to conserve the supplies of steel alloys, the vital materials that make the hard, tough steel modern warfare demands.

✦ ✦ ✦

THE most important material used in modern war is alloy steel. With the rapid increase in production, it quickly became evident that unless steel alloys were conserved, there would not be enough for both the war program and essential civilian demands.

✦ ✦ ✦

IN anticipation of this shortage, representatives of the steel industry, the Society of Automotive Engineers, the Iron and Steel Institute and other technical bodies were called together by the War Production Board to discuss National Emergency Steel Specifications.

✦ ✦ ✦

THE conservation of alloying elements in these specifications is based upon the principle that small quantities of several different alloys are more effective than large quantities of any single element.

✦ ✦ ✦

IT appears that these National Emergency Steels and certain others containing less strategic elements, or none, will soon be the only steels available. It is therefore imperative, it was explained, that industry take the necessary steps to change over as quickly as possible so as to be prepared when the supply of habitually-used steels is cut off.

✦ ✦ ✦

STEELS containing the strategic elements nickel, chromium, tungsten, cobalt and vanadium may only be used on extremely important functional parts. Hence, industry is urged to use carbon and intermediate manganese steels

(*Please turn to Page 252*)

TABLE I
AVAILABLE STEELS

SAE or AISI Number	C	Mn	Ni	Cr	Mo
A 4027	.25-.30	.70- .90	....	....	.20-.30
A 4037	.35-.40	.75-1.00	....	....	.20-.30
A 4063	.60-.67	.75-1.00	....	....	.20-.30
A 4068	.64-.72	.75-1.00	....	....	.20-.30
NE 8024	.22-.28	1.00-1.30	....	....	.10-.20
NE 8124	.22-.28	1.30-1.60	....	....	.25-.35
NE 8233	.30-.36	1.30-1.60	....	....	.10-.20
NE 8245	.42-.49	1.30-1.60	....	....	.10-.20
NE 8339	.35-.42	1.30-1.60	....	....	.20-.30
NE 8442	.38-.45	1.30-1.60	....	....	.30-.40
NE 8447	.43-.50	1.30-1.60	....	....	.30-.40
NE 8547	.43-.50	1.30-1.60	....	....	.40-.60
NE 8620	.18-.23	.70- .95	.40-.60	.40-.60	.15-.25
NE 8630	.27-.33	.70- .95	.40-.60	.40-.60	.15-.25
NE 8724	.22-.28	.70- .95	.40-.60	.40-.60	.20-.30
NE 8739	.35-.42	.75-1.00	.40-.60	.40-.60	.20-.30
NE 8744	.40-.47	.75-1.00	.40-.60	.40-.60	.20-.30
NE 8749	.45-.52	.75-1.00	.40-.60	.40-.60	.20-.30
NE 8817	.15-.20	.70- .95	.40-.60	.40-.60	.30-.40
NE 8949	.45-.52	1.00-1.30	.40-.60	.40-.60	.30-.40

All of the above steels contain .20-.35 silicon and .040 maximum each sulphur and phosphorus.

In addition to the above, the usual plain carbon (1000 series), high sulphur (1100 series), high phosphorus (1200 series), silico manganese (9200 series) steels are available in the various carbon ranges, as are, also, certain other carbon molybdenum (4000 series) steels.

TABLE II
STEEL SPECIFICATIONS

STANDARD SERIES DESIGNATION				POSSIBLE ALTERNATES SAE or AISI Number		
1942 AISI Number	1941 AISI Number	1942 SAE Number	1941 SAE Number	Number	Number	Number
A 1320	A 1321	1320	....	A 4027	NE 8024	....
A 1330	A 1330	1330	1330	A 4037	NE 8233	....
A 1340	A 1340	1340	1340	A 4047	NE 8245	....
A 2317	A 2317	2317	2315	A 4027	NE 8024	NE 8620
A 2330	A 2330	2330	2330	A 4037	NE 8233	NE 8630
A 2335	A 2335	....	....	A 4063	NE 8339	NE 8739
A 2340	A 2340	2340	2340	A 4068	NE 8442	NE 8744
A 2345	....	2345	2345	A 4068	NE 8447	NE 8749
WD2350	....	....	....	A 4068	NE 8547	NE 8949
A 2515	A 2514	2515	2515	A 4027	NE 8817	....
A 3045	A 3045	....	....	A 4068	NE 8442	NE 8744
A 3120	A 3120	3120	3120	A 4027	NE 8024	NE 8620
A 3130	A 3130	3130	3130	A 4037	NE 8233	NE 8630
A 3135	A 3135	3135	3135	A 4063	NE 8339	NE 8739
A 3140	A 3140	3140	3140	A 4068	NE 8442	NE 8744
A 3141	A 3141	3141	X3140	A 4068	NE 8447	NE 8749
A 3145	A 3145	3145	3145	A 4068	NE 8447	NE 8749
A 3150	A 3150	3150	3150	A 4068	NE 8547	NE 8949
A 3240	A 3240	3240	3240	A 4068	NE 8442	NE 8744
WD3250	....	....	....	A 4068	NE 8547	NE 8949
A 4119	A 4119	4119	....	A 4027	NE 8024	....
A 4130	A 4130	4130	X4130	A 4037	NE 8233	NE 8630
A 4137	A 4137	4137	....	A 4063	NE 8339	NE 8739
A 4142	A 4142	....	....	A 4063	NE 8442	NE 8744
A 4145	....	4145	....	A 4068	NE 8447	NE 8749
A 4150	....	4150	4150	A 4068	NE 8547	NE 8949
A 4320	A 4320	4320	4320	..	NE 8124	NE 8724
A 4340	....	4340	X4340	A 4068	NE 8547	NE 8949
A 4620	A 4620	4620	4620	A 4027	NE 8024	NE 8620
A 4640	....	4640	4640	A 4063	NE 8339	NE 8739
A 4645	....	....	....	A 4068	NE 8447	NE 8744
4650	....	....	....	A 4068	NE 8547	NE 8949
A 4820	A 4821	4820	4820	....	NE 8124	NE 8724
A 5045	A 5045	.. ..	....	A 4063	NE 8339	....
A 5120	A 5120	5120	5120	A 4027	NE 8024	....
A 5130	A 5130	....	....	A 4037	NE 8233	....
A 5140	....	5140	5140	A 4063	NE 8339	....
A 5145	A 5145	....	....	A 4068	NE 8442	....
A 5150	A 5152	5150	5150	A 4068	NE 8447	....
A 6120	A 6120	....	....	A 4027	8024	NE 8620
....	....	6130	....	A 4037	NE 8233	NE 8630
WD6140	....	....	....	A 4063	NE 8339	NE 8739
A 6145	....	....	....	A 4068	NE 8442	NE 8744
A 6150	....	6150	6150	A 4068	NE 8447	NE 8749

✦ GOVERNMENT WIRE PRODUCTION INFORMATION ✦

Industrial Plant Expansion

THE estimated cost of war industrial plant expansions approved through December 31, 1941, totaled $7,366,000,000, the Statistics Division of the War Production Board announced recently.

✦ ✦ ✦

COMMITMENTS of public funds, including those of foreign governments financing factories in the United States, amounted to $6,040,000,000, or 82 per cent of the total estimated cost. Of this, commitments by the United States government totaled $5,885,000,000, and those of foreign governments amounted to $155,000,000. The estimated cost of private expansions, as represented by Necessity Certificates approved, was $1,326,000,000.

PLANT expansions estimated to cost approximately $991,000,000 were approved during December. Of this amount, the United States government made commitments totaling $818,000,000, while private financing, as measured by Necessity Certificates approved, amounted to approximately $173,000,000.

Exports and Imports of Wire

AS a wartime measure to prevent vital information being given to the enemy, the Bureau of the Census has suspended publication of the "Monthly Summary of Foreign Commerce of the United States," beginning with the October issue. As soon as this suspension order is rescinded, we will resume publication of Exports and Imports data.

✦ ✦ ✦

Bale Tie Wire

AS of March 17th, producers of bale tie wire are required to reinstate customary minimum discounts of 40 cents per 100 pounds on their sales to manufacturers of bale ties, according to an amendment to Price Schedule No. 6, Iron and Steel Products.

✦ ✦ ✦

"BALE ties" are short lengths of bale tire wire with a twisted loop in one end and are sold in bundles largely to bale agricultural products, wastepaper, old rags, etc.

✦ ✦ ✦

PRICE Schedule No. 6, which was issued on April 17, 1941, required that manufacturers of iron and steel products continue "custo-

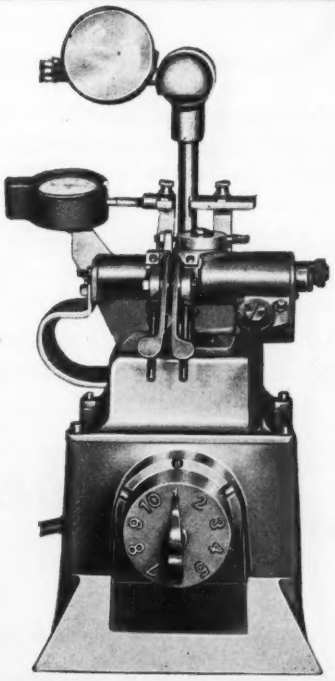
(*Please turn to Page 252*)

MICROMETER PRECISION MICRO-WELD TRADE MARK REG. U. S. PAT. OFF.

CONTINUOUS IMPROVEMENT

MICRO-WELDERS with dial indicating annealing attachments are now available for high carbon wire.

There is positive control of annealing temperature and already hundreds of these special MICRO-WELDERS are proving their dependability and satisfactory performance with leading manufacturers.



Model E.-I-S Welder Capacity .010 to .062" high & low carbon wire.

MICRO PRODUCTS COMPANY

20 NORTH WACKER DRIVE, CHICAGO, ILL.

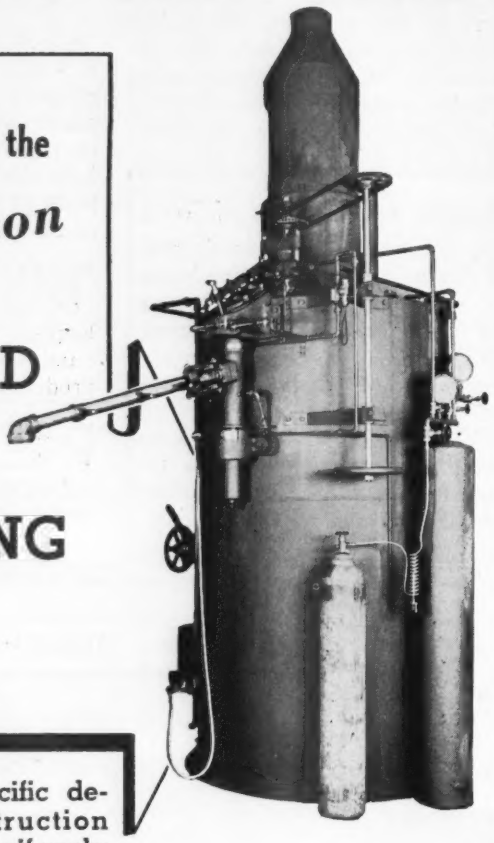
Telephone, State 7468

CLEAN LEAD - Invariably for Making Better Sheath

when using the

Robertson

CLOSED LEAD MELTING POT



Exclusive and specific design and construction features assure uniformly clean lead.

All Robertson Equipment — engineered in entirety by the one manufacturer — is similarly built for the utmost in service and economy.

Write for reasons why the Robertson Closed Lead Melting Pot is so extensively used.

John Robertson Co. Inc.

125 - 137 WATER STREET BROOKLYN, N. Y.

Designers and Builders of

All types of lead encasing machinery for rubber hose and electrical cable manufacturers, including Extrusion Presses, Hydraulic Pumps, Melting Furnaces and Pots, Dies and Cores, Hydro-pneumatic Accumulators and Lead Sheath Stripping Machines.

Government Wire Production Information

(*Continued from Page 251*)

mary and general discounts." Bale tie wire and bale ties are both covered by this schedule.

✦ ✦ ✦

RECENTLY, some steel companies have substantially reduced discounts to manufacturers of bale ties with the result that these latter establishments, which perform an important function in the distribution of many agricultural products and industrial raw materials, have been forced to operate at margins so low as to result in financial loss.

✦ ✦ ✦

OPA has considered its original requirement to be that customary and general discounts must be continued on bale tie wire. However, since most wire producers have misinterpreted the section on discounts, the new amendment has been issued to clarify the schedule and make it mandatory that the bale tie wire discounts be reinstated.

✦ ✦ ✦

Safety Razor Production Curtailed

CURTAILMENT of the production of safety razors, straight razors and razor blades were ordered recently by the War Production Board to save valuable metals.

✦ ✦ ✦

M. D. MOORE, chief of the WPB section in charge of the order, estimated that the order will result in an annual saving of 1,000 tons of special high carbon strip steel and 550 tons of low carbon steel.

✦ ✦ ✦

MACHINERY used in the manufacture of safety razors is suitable for war production. Plants manufacturing most of the razors are already engaged in some direct war work. Restrictions imposed by the order will release additional machine tools for war work.

✦ ✦ ✦

War Production Board Announces Change in Steel Specifications

(*Continued from Page 250*)

(1000-1100-1200 series), carbon molybdenum (4000 series), manganese molybdenum (8000-81000-8200-8300-8400-8500 series) or

silicon manganese (9200 series) wherever possible.

✦ ✦ ✦

THE analyses of the alternate steels which will be available are given in Table I, attached. Existing steel specifications with the National Emergency equivalents are given in Table II.

✦ ✦ ✦

THOSE interested in obtaining these steels can apply to their regular steel sources. Heats have already been made by a number of companies, including the following:

Bethlehem Steel Corporation
Carnegie-Illinois Steel Co.
Copperweld Steel Co.
Pittsburgh Crucible Steel Co.
Republic Steel Corporation
Rotary Electric Steel Co.
Timken Steel and Tube Co.
Youngstown Sheet and Tube Co.

✦ ✦ ✦

IN the early stages of this program it may not be possible for a user to obtain the exact bar size or shape to which he is accustomed and it may be necessary to accept some other size and possibly even a forged bar in order to carry out a test program.

✦ ✦ ✦

TEST steel should be ordered in the usual manner.

✦ ✦ ✦

A New Metal Coating Process

(*Continued from Page 246*)

metal, as against 1500 times the specific heat and weight of the metal so that only one-fifth as much heat will be consumed as when such heat recovery does not take place. The recuperated or recovered heat absorbed by the alloy bath is transformed to the relatively cold metal entering the furnace through bath whereby it is preheated before entering the high temperature salt bath.

✦ ✦ ✦

OF course, the extent to which such economy in power consumption may be carried out is de-

(*Please turn to Page 254*)

Clean Air . . .

product of Research Filters using KEYSTONE Grid Wire

Fresh, clean, invigorating air — it's a factor important to the efficiency of America's 100% war effort. And into army cantonments, government buildings and war production plants are going air filters made by the Research Products Corporation of Madison, Wisconsin. They're hidden away in many heating and air conditioning units, working silently, efficiently.

Research Filter units, during recent years, have incorporated miles and miles of Keystone wire — making up the 12-gauge wire grids which hold the filter pads together. Here is a good example of Industrial Conservation, too . . . for Research Air Filters enable the grids to be used over and over, thus conserving "critical" metals.

KEYSTONE

STEEL & WIRE CO. Dept. W PEORIA, ILLINOIS

HIGH CARBON OR LOW CARBON

SAMSON SPRING WIRE

REG. U.S. PAT. OFF. KEYSTONE STEEL & WIRE CO. PEORIA, ILL.

Bright-Tinned Coppered Annealed Galvanized

A New Metal Coating Process

(*Continued from Page 253*)

termined by the number of heating-cooling chambers employed. Assuming that the furnace is provided with as nearly perfect heat insulation for the several chambers as is attainable, and that the specific heat of the work passing through is constant, in the example illustrated, the power consumption would be reduced in accordance with the expression

$$P = \frac{P_o}{N+1} = P_o \frac{1}{5+1} = \frac{P_o}{6}$$

where N is the number of regeneration chambers, P is the power consumption and P_o is the heat content of the work at full temperature. Since the number of regeneration chambers is five, the power saving is therefore, 5/6ths.

✦ ✦ ✦

OF course, perfect heat insulation is unattainable and therefore, the heat losses from a larger number of regeneration chambers together with a decreasing gain in power economy from the larger numbers would probably make it inadvisable to use more than five regeneration chambers. This number, however, would seem to be amply justified for all heat-treating operations when the particular manner in which the work is cooled or quenched is not an essential consideration.

✦ ✦ ✦

IN order to realize approximately perfect heat transfer from the hot outgoing metal to the relatively cold incoming metal, it is necessary that each of the furnace chambers shall be maintained at a constant proper temperature. Heat loss from the high temperature chambers would be greater than from the chambers of lower temperature with corresponding greater reduction of temperature of the higher temperature chambers. It is therefore, necessary that the external walls of the heat regenera-

PRODUCTION FOR SALE OF IRON AND STEEL PRODUCTS — FEBRUARY, 1942

AMERICAN IRON AND STEEL INSTITUTE
Capacity and Production for Sale of Iron and Steel Products

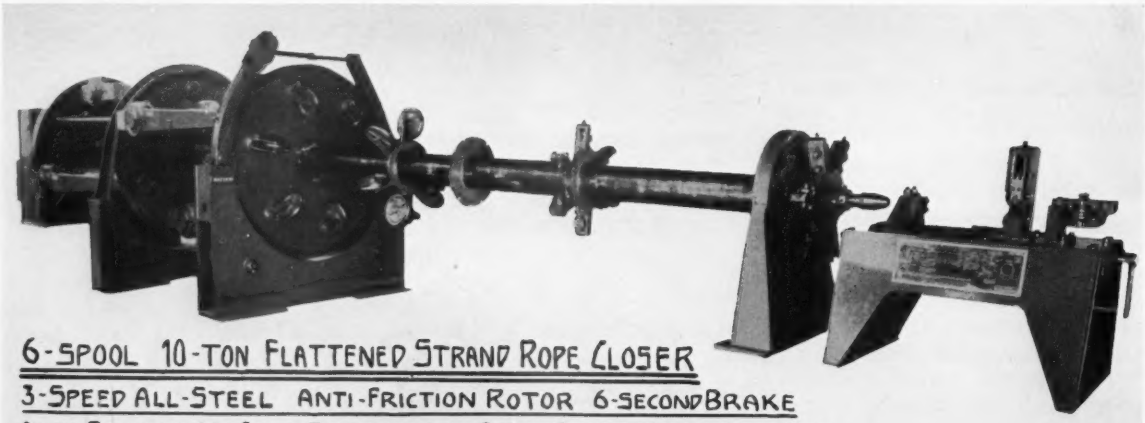
			February - 1942								
Wire rods	21	25	xxxxxxx	98,954	xxx		13,581	211,818	xxx		31,171
Wire—Drawn	42	26	2,338,090	159,726	89.0		2,516	360,438	95.3		6,174
Nails and staples	19	27	1,152,170	58,391	66.1		xxxxxxx	119,869	64.3		xxxxxxx
Barbed and twisted	15	28	461,270	24,415	69.0		xxxxxxx	51,081	68.5		xxxxxxx
Woven wire fence	16	29	766,485	17,398	29.6		xxxxxxx	37,498	30.3		xxxxxxx
Bale ties	11	30	114,910	6,335	71.9		xxxxxxx	11,815	63.6		xxxxxxx
All other wire products	9	31	71,020	3,223	59.1		xxxxxxx	6,326	55.1		xxxxxxx
Fence posts	12	32	120,185	3,896	42.3		xxxxxxx	7,638	39.3		xxxxxxx

THE WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY



6-SPOOL 10-TON FLATTENED STRAND ROPE CLOSER

3-SPEED ALL-STEEL ANTI-FRICTION ROTOR 6-SECOND BRAKE
ANTI-FRICTION, NO-SLAP, RETRACTABLE-SPOOL-PINTLE, ROPE-FRICTION-CRADLES WITH QUICK-RELEASE CRADLE-SHAFT CLUTCHES AND VARIABLE 1 IN 8 TO 1 IN 50 POSITIVE-DRIVE CUSHIONED BACKTURN
U.S. PATENTS: 2 208 914, 2 270 093

W-2038 -A

tion chambers shall be very carefully insulated. The flow of heat through the dividing or separating walls between these chambers is not quite so serious, since the amount of heat which flows into a chamber through its separating walls at one side thereof is balanced by the outward flow of heat from the chamber through its opposite side wall so that the temperature level would not be affected.

✦ ✦ ✦

IT will be noted that the metal strips traveling through the furnace chambers in opposite directions are very closely related, thus facilitating the rapid transfer of heat. These metal strips upon entering the high temperature chamber, pass upwardly through the salt bath and then downward into and through the lead bath. The alloy wipes off any adhering particles of the salt bath materials. In this manner, commingling of the different regenerative bath materials is prevented so that change in the different temperature levels in these baths from this cause is avoided.

✦ ✦ ✦

SUMMARIZING briefly, it has been shown that preheating and fluxing in one operation in new salt bath material is now practicable, and that the internal heating of such baths is desirable and economical.

✦ ✦ ✦

"Metal Cleaning in War Time"

THIS is the title of a new handbook just issued by the **Magnus Chemical Company, Inc.**, manufacturers of Industrial Cleaning Materials, Emulsifying Agents and Metal Working Lubricants.

✦ ✦ ✦

THE handbook discusses metal cleaning problems in the production of shells, shell cases, fuses, other munitions, parts and objects involved in the production of material and equipment important to the War Program.

✦ ✦ ✦

IN addition to the specific cleaning problems of munitions, this handbook also covers the cleaning operations required in the production of ordnance, small arms, material, transport equipment and other metal items which must be built to meet the demands of the war.

SPECIAL emphasis is placed on the new Magnus Emulso-Dip and Emulso-Spray methods of removing oily dirt, drawing compounds and metal particles from metal objects. This is a timely subject in view of the serious shortage of Chlorinated Solvents for metal degreasing.

✦ ✦ ✦

THE handbook is illustrated with flow charts, pictures and diagrams of washing machines used in the manufacture of munitions and other vital metal objects.

SEVERAL pages are devoted to cleaning in maintenance and repair shops and the important subject of the cleaning and protection of employees' hands and skin.

✦ ✦ ✦

COPIES of the Magnus "Metal Cleaning in War Time" handbook can be obtained by writing to the Magnus Chemical Company, Inc., Garwood, New Jersey.

✦ ✦ ✦

PLEASE mention **Wire & Wire Products** when writing for your copy or copies.

WIRE and BAR DIES
EXTRUDING DIES
TUBING DIES
SIZING DIES

•

Carbide Blanks, Tools, Bits, Reamers, Broaches, Forming Tools

More tonnage per day — more tonnage per die!

That's the report from every plant when TECO Carbide Dies go on the job. And it's all high quality tonnage, held to accurate tolerance and unblemished finish through every pound of production. This high-speed, long-run capacity of TECO Carbide Dies is due to their rigidly controlled uniformity, density and hardness, which reduces wear and friction to a new low. Let a test run prove this in YOUR plant. Our engineers will gladly discuss your requirements.

TUNGSTEN ELECTRIC CORPORATION
564 39th Street • • • Union City, N. J.
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Pioneers in Tungsten Carbides for Over a Quarter Century

Hot Dip Tinning of Carbon Steels

(*Continued from Page 242*)

ALL the samples in a rack were tinned at the same time as follows: The specimens were first pickled 5 minutes in 3.5 normal hydrochloric acid at 140°F, washed, and rough tinned at 625°F. A mixture of ammonium chloride and stannous chloride was used as a flux cover on the roughing kettle. The specimens were in the roughing kettle 20 seconds, then removed through uncovered tin, and put in the soaking kettle for 10 seconds at 485°F. After soaking, the specimens were dipped in the finishing kettle at 525°F for four seconds and "listed" for 5 minutes to allow slow solidification of the tin. The specimens were not cleaned or wiped at this time. This procedure was decided upon as it represents the practice used for tinning clean surfaced steel at the plant where the specimens were tinned. This procedure was repeated for each of the four sets, all specimens in one set thus being tinned at the same time.

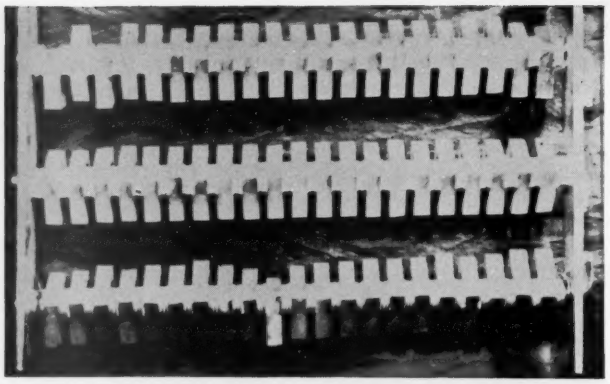


Figure 1. One of the Four Racks of Specimens Before Tinning.

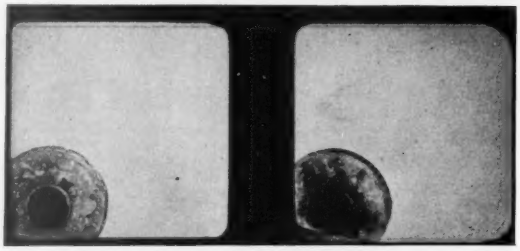
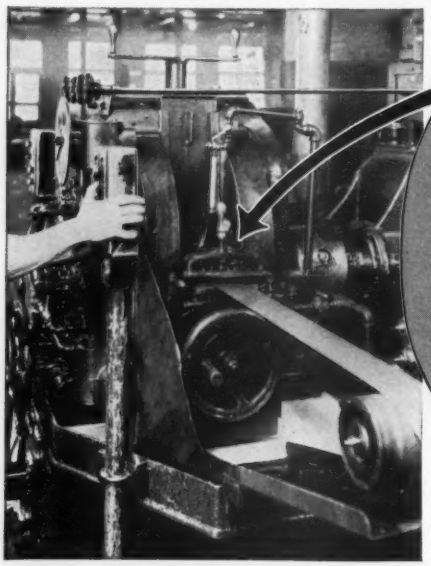
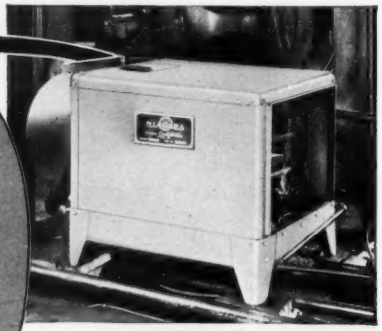


Figure 2. Two Typical Samples After Tinning.

THE racks were cut apart on a metal cutting band saw. Fig. 2 is a photograph of two typical



COOLING LUBRICATING and CUTTING OIL with the NIAGARA *Aero* HEAT EXCHANGER



PATENTED

NIAGARA BLOWER COMPANY
Dept. WP-52
6 E. 45th Street New York City
37 W. Van Buren St., Chicago, Ill.
Fourth & Cherry Bldg., Seattle, Wash.
673 Ontario St., Buffalo, N. Y.
Sales Engineers in Principal Cities

Lower cost cooling with accurate automatic control of temperature is given by the NIAGARA AERO HEAT EXCHANGER in a wide range of applications. Lubricating rolls in strip mill—cutting oil in 24 hours operation of automatics —quenching baths in steel treating—cooling engine and machine jacket water—hydraulic fluids—industrial coolants.

Water saved is over 95% of continuous flow cooling water. Closed system prevents adulteration or dilution of coolant. Controlled temperature prevents solidifying of waxes or breaking down of oils or solutions. Write for Bulletin 90.

NIAGARA *INDUSTRIAL* COOLING • HEATING • DRYING
HUMIDIFYING • AIR ENGINEERING *EQUIPMENT*

specimens, natural size. The dark area around the hole was where the washers were in contact with the specimens. The corner of the specimen at the hole was the top during tinning, and the corner opposite it was the first part of the specimen to enter the tin pot. The corner opposite the hole was in contact with the listing plate, and thus the last tin to freeze is located here.

✦ ✦ ✦

End of Part I

Part II of this article will be published in the June 1942 issue of WIRE & WIRE PRODUCTS and will cover testing of the tinned specimens and discussion of the results of these tests, including (1.) Appearance of the Specimens after Tinning, (2.) Metallographic Examination of Tin and the Iron-Tin Compound Layer.

✦ ✦ ✦

Part III published in July will continue the above subject and will contain (3) Thickness of Tin Coating, (4) Determination of the Number of Pin-Holes or Discontinuities in the Tin Coating, (5) Conclusions and Discussions of Conclusions, (6) Table of References.

Powder Metallurgy as a Help to National Defense

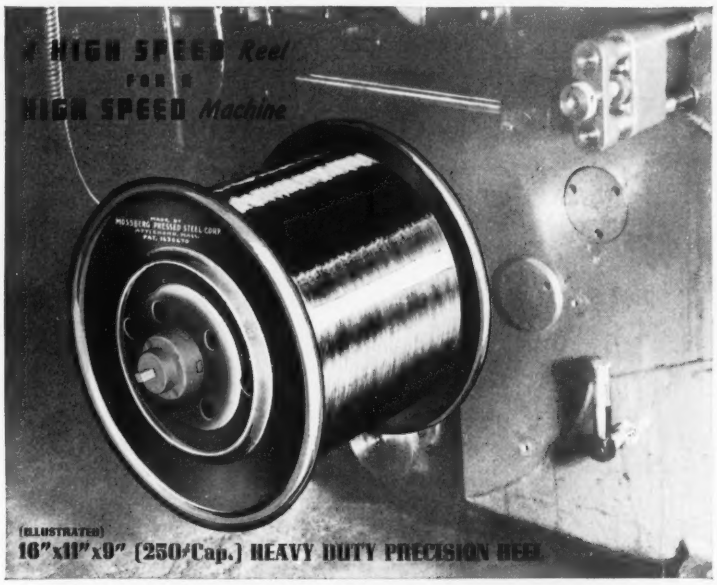
(*Continued from Page 248*)

IT will be seen that powder metallurgy lends itself particularly to the production of the many parts urgently required in war time. A great many parts are not in regular production at rates which have heretofore been unheard of. For instance, one very essential part has just been offered at a production rate of not less than 500,000 pieces per day with a step-up to 1,000,000 pieces daily within a matter of weeks. Another part, which at the present moment requires tedious machining processes with from 60-70% scrap, can now be produced at the rate of 20,000 pieces per day with no scrap. It goes without saying that under present conditions it is not permissible to go into detail or name the parts produced by this art, but wherever the problem of powder metallurgy is understood, manufacturers have been able to obtain government contracts for sizeable production.

For Information
Regarding
The Wire Association
Address
Richard E. Brown, Secretary
300 Main Street, Stamford, Conn.

Bulletin on Welding Electrodes

THE "Frostrode" process of refrigerated welding, through which welding electrodes are actually so cold as to be continually covered with frost, is described in a new four-page bulletin just issued by the **Frostrode Division of Weltronic Corporation,** East Outer Drive, Detroit. In addition to greatly increasing spot weld runs between tip dressing, it overcomes, by eliminating undesirable heat at the electrodes, many difficulties hitherto encountered in armorplate and aluminum welding. Copies of the Bulletin may be obtained directly from Weltronic or from this publication.



MOSSBERG **PRESSED STEEL** CORP.

OFFERS: BALANCED PRECISION REELS

in HEAVY DUTY construction for use on modern HIGH SPEED wire drawing machines.

To provide higher operating efficiency, with the ever increasing tendency towards the drawing of finer gauge wire on larger reels at higher speeds, the following reel requirements are now essential:

(1) PROPER PROPORTION
(2) BALANCE
(3) ACCURACY
(4) STRENGTH
(5) DURABILITY

All these requirements are incorporated in spools & reels made by

MOSSBERG PRESSED STEEL CORP.

18 WEST STREET ATTLEBORO, MASS., U. S. A.

Outstanding Personalities of the Wire Industry

E. M. Hicok, Personnel Relations Mgr., Mfg. Dept., Western Electric Company

EDWARD M. HICOK, for the last three years comptroller of manufacture for the Western Electric Company, has been appointed to the new Company post of personnel relations manager for the Manufacturing Department, effective February 1, 1942. Succeeding Mr. Hicok as comptroller of manufacture is **John M. Stahr,** who has been Works comptroller of the Company's Hawthorne (Chicago, Illinois) plant since 1936.

✦ ✦ ✦

MR. HICOK joined Western Electric in 1901, at the Company's Hawthorne Works, and ten years later he was made chief of the payroll and shop cost division there. Following a period of service in other supervisory posts, in 1929 Mr. Hicok was called to the Company's newly opened Works at Point Breeze, Baltimore, to become superintendent of the telephone apparatus shops and chief of industrial relations. In 1938 he came to the Company's New York headquarters as comptroller of manufacture.

✦ ✦ ✦

CAPT. WM. H. BASSETT, JR.,
Ordnance Department, U. S. Army,
Office Chief of Ordnance,
Washington, D. C.

ENLISTED in the Engineers Corps on February, 1918. Attended the Officers' Training School at Carnegie Institute of Technology during the Spring of 1918. Sergeant of Ordnance, October 24th, 1918. Discharged from the Army January 20, 1919. Received commission 2nd Lt., October 28, 1919, 1st Lt. commission on March 5, 1924 in the Ordnance Reserve, and Captain on February 2nd, 1929.

✦ ✦ ✦

TRAINED at Aberdeen Proving Grounds in 1936, Springfield Armory, 1929 and Massachusetts Institute of Technology 1931. Ordered to active duty February 5th, 1942.

✦ ✦ ✦

CAPTAIN BASSETT has been associated with Anaconda and American Brass for 25 years as Assistant Metallurgist with the American Brass Company and as Manager of Metallurgical Development with the Anaconda Wire & Cable Company. He is a member of the Executive Committee of A. I. M. E., American Transit Association, A. I. E. E., American Society for Metals and a member and former Director of the Wire Association.

The Trend is Toward

JETAL

the JETAL process

PATENTED

THE ORIGINAL BLACK OXIDE FINISH FOR IRON & STEEL

JETAL shows the way to faster production . . . to more effective protection. Enthusiastic users, in ever-increasing numbers, turn to JETAL for the final answer to their finishing problems.

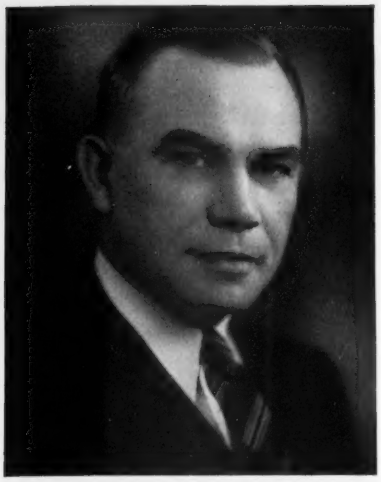
- **JETAL** gives 50% to 70% more abrasion and wear resistance — as high as 230% by changes in procedure.
- **JETAL,** with proper protective oils or lacquers, offers high salt spray resistance.
- **JETAL** assures 100% increase in production.
- **JETAL** saves you 30% in price . . . and goes further.

Substitute JETAL for nickel, zinc, cadmium and tin plating.

Immediate delivery — any quantity. Send samples for JETALizing without charge. Consultation service without obligation.

ALROSE CHEMICAL COMPANY

Providence, R. I. **Tel. Williams 3000**



CARL E. JOHNSON
Supt. Rod & Wire Mills,
Bethlehem Steel Company
Sparrows Point, Maryland
President, The Wire Association

Born Marquette, Mich. Graduate Mining Engineering, Michigan College of Mines (Now Michigan College of Mining and Technology) Houghton, Mich., 1923. While student spent one year working underground and in the open pit mines of the Marquette and Mesabi Iron Ranges. 1923-1925 open hearth department, Bethlehem Steel Company. 1925-1926, Construction Department, Bethlehem Steel Company during construction of wire mill. Upon its completion in 1926 became Assistant Superintendent. In 1937 appointed Superintendent of Rod and Wire Mils.

✦ ✦ ✦

MR. JOHNSON was elected President of the Wire Association at the Directors' Meeting held at New York, N. Y., on March 23rd, 1942.

✦ ✦ ✦

PRIVATE JOS. TROMBITAS
Air Corps, U. S. Army
Tyndall Field, Fla.

FORMER bookkeeper and stenographer of WIRE & WIRE PRODUCTS, enlisted in the regular army October, 1941, and attended the Air Corps Clerks' Training School at Denver, Colo. Upon graduation he was assigned to duty at Tyndall Field at Panama City, Fla., where he is now stationed.

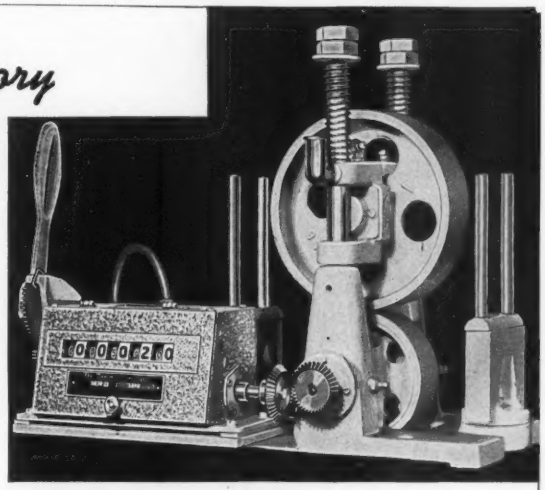
✦ ✦ ✦

Northwestern Steel & Wire Personnel Changes

H. E. ROMAN, formerly assistant wire mill superintendent of the Northwestern Steel & Wire Co., Sterling, Ill., has been promoted to superintendent of the wire mill. He succeeds **P. M. Murphy**, who has become associated with the Republic Steel Corp., as wire mill superintendent in the Chicago district. **W. A. Blum** has been advanced from general foreman, wire drawing department, to assistant superintendent of the wire mill, replacing Mr. Roman, while **Alexander Skekel**, formerly identified with Pittsburgh Steel Co. has become general foreman of the wire drawing department.

(*Please turn to page 260*)

Your Victory Production Program demands *Accurate Production* "Count"



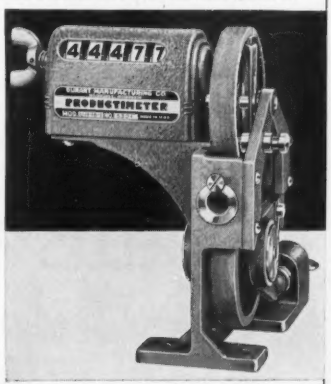
WITH **PRODUCTIMETER**
WIRE MEASURING MACHINES

Action . . . every minute of every day, from every machine on the industrial "first line of offense!" That is your part in the fight for Victory. Nothing must stop you and in that determination, Productimeters can help you vitally . . . by keeping accurate, automatic count of machine out-put. No guesswork, no manual checking and re-checking . . . no priceless man-hours wasted in getting facts and figures for production control.

Investigate your counting methods at once. If they are not suited to the emergency pace, act at once to equip your machines with up-to-the-minute Productimeters.

The line includes units for every wire measuring requirement . . . for every type of product: Insulated Cable, Wire, Rope, Chain, Braid, Bare Copper Cable, rough-surfaced Conductor, greasy, oily materials. Speeds from 500 to 5,000 counts per minute . . . Diameters from 0" to 3½" . . . and they're strong and durable, designed to do the work you expect of them.

Send for Complete details in Catalog No. 3



Above: Type ME with Predetermined Counter having Quick Lever Reset for instantaneous resetting. Automatically stops machine or signals operator when predetermined quantity has been run.

Right: Model L-H-16-1 with Wing Nut Reset. Designed for general service, moderately priced. Also available with Lock and Key Reset, or Quick Lever Reset.

DURANT MANUFACTURING COMPANY
1918 N. Buffum St., Milwaukee, Wis. 176 Eddy St., Providence, R. I.

PRODUCTIMETERS
THE SPEEDOMETERS OF INDUSTRY

Outstanding Personalities of the Wire Industry

(*Continued from Page 259*)

H. J. French Joins Iron & Steel Branch of W. P. B.

H. J. FRENCH, Metallurgist, in Charge of Alloy Steel and Iron Development in the Development and Research Division of The International Nickel Company, Inc., in New York, has been appointed Senior Technical Consultant in charge of the Metallurgical and Specifications Section of the Iron and Steel Branch of the War Production Board by **C. E. Adams**, Chief of Branch. Mr. French is Vice-President and a member of the Board of Trustees of the American Society for Metals.

✦ ✦ ✦

Carl I. Collins, Executive Vice President, Wickwire Spencer Steel Co.

CARL I. COLLINS was recently elected to the board of directors of the Wickwire Spencer Steel Co., New York, and named executive vice-president. Mr. Collins joined the Hyatt Roller Bearing Company after serving in the American armed forces during the last war and in 1923 became plant superintendent and later assistant to the vice-president of the Morris & Bailey division of the Oliver Iron & Steel Corp.

✦ ✦ ✦

FOLLOWING acquisition of the Oliver company by the American Steel & Wire Co. in 1930, Mr. Collins was made general manager of the Morris & Bailey division and, in 1933, was named general superintendent of the Cuyahoga works, where he was in charge of the billet, rod, wire and cold rolled strip mills and auxiliaries. In 1935 he was made manager of operations of the Worcester district of the American Steel & Wire Co. and is resigning this position to join Wickwire Spencer.

✦ ✦ ✦

Oscar T. Marzke, Wks., Met., Waukegan Wks., American Steel & Wire Company

PERSONNEL changes involving two members of the metallurgical department in Worcester, Mass., have been announced by American Steel & Wire Co., United States Steel subsidiary.

✦ ✦ ✦

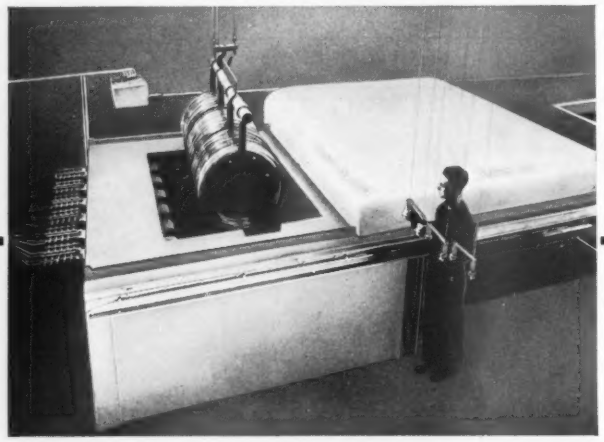
OSCAR T. MARZKE, formerly works metallurgist at North Works, Worcester, has been named works metallurgist, Waukegan, Ill. **Wade B. Houk** has been appointed to succeed Mr. Marzke as works metallurgist at North Works.

✦ ✦ ✦

BORN in Lansing, Mich., Mr. Marzke attended Michigan State University and Massachusetts Institute of Technology before starting to work for the Wire Company in the physical laboratory at South Works, Worcester, in April, 1933. He was moved along to various other positions before being named works metallurgist at North Works in November, 1940.

✦ ✦ ✦

MR. HOUK was born in New Brighton, Pa., and attended public schools in that city before entering and being graduated from Pennsylvania State College. He worked three years for Republic Steel Corp. before becoming asso-



300 K. V. A. Bellis Electric Furnace annealing wire at the rate of about 1,000 pounds every 15 minutes, assuring:

Better Physical Properties	Controlled Medium
Better Temperature Control	More Uniform Product
Better Shop Conditions	Reduced Inventory
Less Equipment Investment	Greater Output
Less Floor Space	Better Surface
Lower Maintenance Cost	No Dirt or Smoke
Lower Heat Cost	No Excess Heat

THE BELLIS HEAT TREATING CO.

Branford, Connecticut

Originators of

LAVITE AND BELLIS FURNACES

ciated with American Steel & Wire in October, 1936, as a product metallurgist at Worcester, which post he has held to the present time.

✦ ✦ ✦

Maurice C. Fetzer, Research Metallurgist, Carpenter Steel Co.

DR. MAURICE C. FETZER, formerly assistant professor of metallurgy, Pennsylvania State College, has joined the Carpenter Steel Company of Reading, Pa., as research metallurgist. He is a member of the American Society for Metals, American Institute of Mining and Metallurgical Engineers and British Iron and Steel Institute.

✦ ✦ ✦

Walter F. Munford, Manager of Operations, Worcester District, American Steel & Wire Co.

WALTER F. MUNFORD, manager of operations, Worcester district of the **American Steel & Wire Company**, was born in Worcester, Massachusetts on June 8, 1900. He was educated in the Worcester schools and attended the Worcester Polytechnical Institute where he majored in mechanical engineering. Later he matriculated at Massachusetts Institute of Technology, where he majored in the same subject.

✦ ✦ ✦

MR. MUNFORD'S first position with the **American Steel & Wire Company** was during his Summer vacation in 1919 when he worked as a die reamer at the company's North Works in Worcester. After leaving school he became a helper in the open hearth department in the same city. Following this, came two other positions before he was made superintendent of the open hearth in 1927. In 1930 he was transferred to Cleveland, where he became superintendent of the open hearth at the company's Newburgh Works. Three years later when this division was dismantled, he was transferred to the National Tube Company at Lorain, Ohio, as assistant superintendent of the Steel Works. Mr. Munford became assistant superintendent at the Wire Company's Cuyahoga Works in Cleveland in 1934 and superintendent in January, 1937. After a period as assistant to the vice-president of the company in 1939, he was made assistant manager of operations, Pittsburgh district, in December of that year.

✦ ✦ ✦

E. Stanley Glines, Chief of Aluminum & Magnesium Unit of OPA

APPOINTMENT of **E. Stanley Glines** as chief of the aluminum and magnesium unit of the Office of Price Administration was recently announced.

✦ ✦ ✦

MR. GLINES has had a broad background in the industrial and banking field for more than 30 years. During the period that Herbert Hoover served as Secretary of Commerce, Mr. Glines was chairman of an advisory committee on Far Eastern affairs to that department.

✦ ✦ ✦

ON December 31, 1941, Mr. Glines resigned as senior partner of Glines & Co.; New York bankers and industrial consultants. He had been a member of that firm since 1937. From 1927

(*Please Turn to Page 263*)

WIRE ASSOCIATION PITTSBURGH REGIONAL MEETING

Will Be Held At The

WM. PENN HOTEL — PITTSBURGH, PA.

FRIDAY, MAY 22nd, 1942 — 6:00 P. M.

— PROGRAM —

Dinner — 6:30 P. M. — William Penn Hotel
Speaker — Colonel Frank W. Bullock,
Signal Corps, U. S. Army
— Intermission —
Technical Session
SUBJECT: Bullet Core Wire
Papers
"Drawing of Core Wire"
"Cold Heading of Core Wire"
"Casing of Core Wire"

After presentation of papers a general discussion will be held which will be entirely "off-the-record."

Registration Fee — Including Dinner — $3.00

CHAIRMAN OF COMMITTEE
A. R. Zapp, Manager, Firthaloy Div.,
Firth-Sterling Steel Co., McKeesport, Pa.

Please Make Early Reservation to
RICHARD E. BROWN
300 Main Street Stamford, Conn.

A Review of Recent Wire Patents

No. 2,275,198, COATED METAL WIRE, patented March 3, 1942 by Winton I. Patnode and William J. Scheiber, Schenectady, N. Y., assignors to General Electric Company, a corporation of New York.

A smooth, flexible, glossy coating, tightly adheres to the wire and is composed of a superpolyamide modified with 10 to 40 per cent by weight of shellac.

✦ ✦ ✦

No. 2,275,563, APPARATUS FOR CONTINUOUSLY PROCESSING WIRE, patented March 10, 1942 by Irving L. Sharlow, Massena, N. Y., assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania.

Grooved feed rollers are provided for moving the wire onto a wire guide, the grooves encircling the wire. A lubricant solvent is fed to the wire as it moves between the rollers so that the solvent is spread to loosen the lubricant.

✦ ✦ ✦

No. 2,276,002, METHOD OF MAKING SPRING INSERTIONS, patented March 10, 1942 by George Torok, Budapest, Hungary, assignor to Magyar Ruggyantaarugyar Reszvenytarsasag, Budapest, Hungary, a corporation of Hungary.

The method comprises withdrawing wire axially in one direction from a spool having turns of wire wound thereon, sufficient to form a first spring, withdrawing a sufficient length of wire laterally

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

of the spool to form a connecting piece between the first spring and a second spring to be formed, and forming the second spring by withdrawing sufficient turns of wire axially of the spool in a direction opposite to the first-mentioned direction.

✦ ✦ ✦

No. 2,276,042, WIRE ROPE CONSTRUCTION, patented March 10, 1942 by Ernest V. Jacobson, Ironwood, Mich.

This assembly comprises a number of wire strands helically wound around a yieldable central core, and live rubber interposed between the outer strands and the central core whereby the rope will be inherently flexible and whereby the rubber is sufficiently formative to permit the outer strands to move toward the central core when a load is applied to the rope, the rubber entering the interstices between the core and wire strands so that no water may be trapped therein by closing of the strands about the core.

✦ ✦ ✦

No. 2,276,353, PROCESS OF COATING, patented March 17, 1942 by John S. Thompson, Detroit, Mich., assignor to Parker Rust Proof Company, Detroit, Mich.

The process is applicable to treating a surface of a metal such as iron, steel, aluminum and their alloys, and comprises subjecting the surfaces to the action of an aciduated heated solution containing as its chief active ingredients the SiF_6 radical and a compatible oxidizing agent, and treating the metallic surface until a visible protective paint-holding coating is obtained and thereafter applying to the metal surface a coating of one of the group consisting of paints, lacquers and enamels.

✦ ✦ ✦

No. 2,276,516, CUSHION, patented March 17, 1942 by Nancy Roy, Miami, Fla.

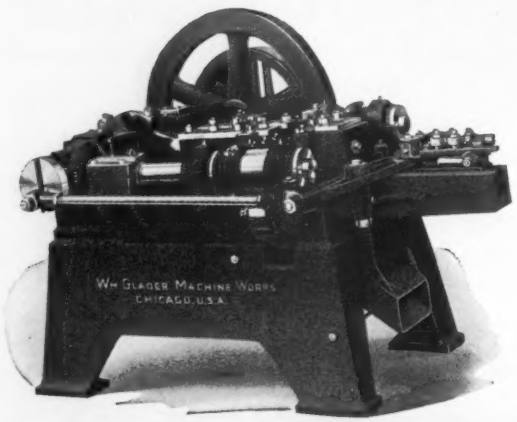
End convolutions of the spiral wire springs making up the cushion are encased in resilient sheaths.

✦ ✦ ✦

No. 2,276,579, SPRING COILING MACHINE, patented March 17, 1942 by Elmer W. Halvorsen and Charles R. Bergevin, Torrington, Conn., assignors to the Torrington Manufacturing Company, Torrington, Conn., a corporation of Connecticut.

The assembly includes feed rolls capable of intermittent rotative movement, a coiling arbor and a coiling abutment capable of relative movement with respect to the coiling axis, of means for controlling the relative positions of the arbor and abutment to form wire as fed continuously by the rolls into a coiled spring with extended ends, and means

GLADER WIRE NAIL MACHINE SCORES AGAIN



WM. GLADER MACHINE WORKS

210 N. Racine Ave. Chicago, Illinois

A new Wire Mill under construction in the State of Texas will install GLADER WIRE NAIL machines 100%.

The production figures on common nails shown below, are guaranteed.

SIZE MACH.	SIZE WIRE	MAX. LENGTH OF WIRE	NUMBER OF NAILS PER MIN.	CAP. IN POUNDS PER HR.
#00A	#16	1⅛"	700	37.2
#00	#14	1¼"	550	55
#0	#12	1¾"	450	89
#1	#10	2½"	400	192
#2	#8	3½"	325	310
#3	#4	5"	225	523
#4	#1	7"	190	622
#4s	5/16"	9"	175	1155
#5	⅜"	12"	160	2400

This high output and economical operation account for the GLADER machine being accepted as standard equipment in all recent installations.

to shift the arbor while the rolls are stationary, to cause severance of a completed spring.

✦ ✦ ✦

No. 2,276,973, INSULATED ELECTRIC HEATER AND METHOD OF MAKING THE SAME, patented March 17, 1942 by Homer D. Holler, Export, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania.

About the resistor wire is a coating of insulating material, comprising a hard dense, non-corrosive material having a high electrical resistivity and comprising an intimate and homogeneous mixture of magnesium oxide and magnesium borate as essential binding elements thereof.

✦ ✦ ✦

No. 2,277,145, REINFORCING CABLE, patented March 24, 1942 by Robert C. Pierce, Niles, Mich., assignor to National-Standard Company, a corporation of Michigan.

A number of bent wires, arranged close together, with only point contact are provided, having a rubber covering penetrating through the cable.

✦ ✦ ✦

No. 2,277,338, DRAWING DIE, patented March 24, 1942 by Carl V. Luginbill and Paul Bieberich, Fort Wayne, Ind.

This die comprises a support having an opening therein which tapers outwardly in opposite directions from approximately the middle thereof, two opposed plugs within the opening and having recesses in the opposed faces thereof, and a drawing member engaged in both recesses, the plugs being adapted to soften when heated to a selected temperature and to expand laterally under pressure to entirely fill the opening and rigidly lock the drawing member in the support against dislodgement irrespective of the wire drawing direction.

✦ ✦ ✦

No. 2,277,339, DRAWING DIE, patented March 24, 1942 by Carl V. Luginbill and Paul Bieberich, Fort Wayne, Ind.

In this die, the die-holder has a series of conduits formed about the drawing member and extending in wire drawing direction from one face of the holder to the opposite face and lateral conduits leading from the former conduits to the outer side of the holder, the conduits being adapted to conduct a cooling medium through the holder which is projected against the face of the holder having the entrances to the conduits therein.

✦ ✦ ✦

No. 2,277,664, ZINC PLATING FERROUS ARTICLES, patented March 31, 1942 by Richard O. Hull, Lakewood, Ohio, assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware.

This process is particularly applicable to zinc plating cleaned iron or steel articles upon which the hydrogen overvoltage is so low as to interfere with the deposition of the zinc from a cyanide-zinc bath.

✦ ✦ ✦

No. 2,277,668, ZINC PLATING, patented March 31, 1942 by Clayton F. Ruebensaal, Cleveland, Ohio, assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware.

For the electro-deposition of zinc from a sodium zincate bath, the step comprising depositing zinc from an electrolyte comprised essentially of sodium zincate and free of cyanide, deposition being effected in the presence of from about 7 to 30 grams per liter of a substance selected from the group consisting of glycollic acid and its salts.

✦ ✦ ✦

Outstanding Personalities of the Wire Industry

(*Continued from Page 261*)

to 1937, Mr. Glines served as president of the American Continental Corp. Prior to this, he was a partner in Lam, Glines & Co., an affiliate of the Stone & Webster Corp. Lam, Glines & Co., at one time, was the second largest owner of industrials and public utilities in China.

✦ ✦ ✦

MR. GLINES will retain his present posts as chairman of the board of two bondholders' protective committees, the St. Louis & Southwestern R. R. and the Chicago, Milwaukee & St. Paul R. R.

Airplane Switch Springs of
Callite *Beryllium* Copper Wire

"Switches used in airplanes must be absolutely dependable under all weather conditions. Because springs play such an important part in the life of switches," writes ***Robert Hetherington,*** founder of ***Robert Hetherington & Son, Inc.,*** "we use springs formed by ***Instrument Specialties Co.*** of Callite beryllium copper wire.

"We have always found these springs to be accurately made and absolutely dependable in switch operations numbering into the hundreds of thousands."

▶ Callite's high standards guarantee dependable uniformity in structure, temper, size and forming reaction. Our technicians will gladly recommend the most suitable composition for your specific requirements.

▶ Callite Tungsten Corporation, 572—39th Street, Union City, N. J. Branches: Chicago, Cleveland.

**The small switch pictured above has a capacity of 50 amps. at 24 volts DC inductive load. Beside the ball springs shown, two others are employed—a head spring inside the plunger and return spring in the base. Functioned "O. K." in altitude tests at 45,000 ft.*

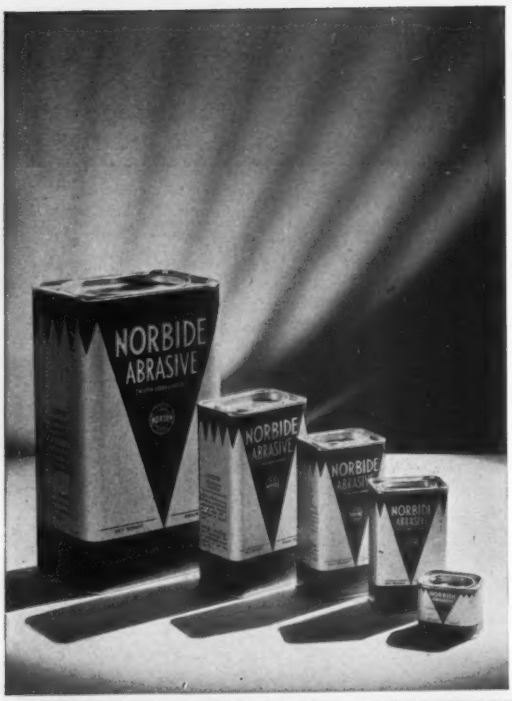
CALLITE FINE WIRES
in sizes as small as .002" furnished in these metals and alloys . . . for spring, control cables, instruments, control devices, wire cloth, scratch brushes and other applications.

ALUMINUM
BERYLLIUM COPPER
BRASS—ALL GRADES
BRUSH WIRE
COMMERCIAL BRONZE
EVERDUR
NICKEL-SILVER
PHOSPHOR BRONZE
SILVER
SPECIAL ALLOYS
STAINLESS STEEL

CALLITE TUNGSTEN CT

Callite Wires

A FINE WIRE FOR EVERY NEED



NORBIDE
ABRASIVE

For
Cemented
Carbide
Dies

Used in place
of diamond
dust it reduces
the cost of shaping,
ripping and
finishing.

NORTON COMPANY
WORCESTER, MASS.

N—38

NORTON ABRASIVES

700 Spools
an hour!

Assembly of Clark *All-Metal* Spools is made under a patented process at the rate of 700 an hour, on either hand or power press. No spot fitting necessary. Thus — increased output, reduced cost.

Clark Spools are strong because of the embossing and curled edges of the ends, nibs in the plug which prevent turning of end on barrel, and because the whole circumference of the barrel is locked into plug and end.

Made in 5″, 6½″ and 10½″ diameter ends; barrels in $1\frac{15}{16}$″ diameter (or special 3½″ diameter for 10½″ end) in any length. Material is cold rolled steel in gauges to meet your demands for strength.

Samples and prices will be sent at your request.

★

J. L. CLARK MANUFACTURING CO.
600 23rd Avenue
ROCKFORD, ILLINOIS
★
901 Chrysler Building
NEW YORK, NEW YORK

Electrical Developments in the Steel Industry During 1941

By F. Mohler

Industrial Engineering Dept.
General Electric Company
Schenectady, N. Y.

THE unprecedented requirements of our Defense Program have made it necessary to place steel on the critical list of materials in spite of the fact that steel production for the year past has been operating at an all-time peak. At the end of 1941 capacity had reached 89,000,000 tons and some 84,000,000 tons had been produced. This has been made possible to a large extent by rebuilding and modernizing the existing blast furnaces, Bessemer converters, open-hearth furnaces, and coke ovens. However, a number of new installations of such units were required to meet this production.

✦ ✦ ✦

THERE has also been considerable activity in rolling mill, finishing, and processing equipment. In addition, the shortage of power has focused attention on power-generating equipment, and several of these projects are already under way.

✦ ✦ ✦

HAND in hand with steel progress, a tremendous program of expansion has taken place in the brass and aluminum industries.

✦ ✦ ✦

THE electrical industry has played no small part in this expansion program and, in spite of the pressure to produce a vast amount of electric equipment, it has found time to bring forth many new developments leading to improved quality and increased productivity.

✦ ✦ ✦

Cold Strip Mills

THE world's fastest cold-strip mill, with a nominal operating speed of 3300 fpm and a maximum speed of 3850 fpm, went into successful production early in 1941. Tinplate has already been rolled successfully on it at 3750 fpm, and it has broken all records for production.

A NUMBER of new developments contribute to the success of this mill. In the first place, it is the highest powered cold-strip mill, being driven by 11,400 hp, which requires an 8000-kw motor - generator set. The two 4000-kw generators for this set are the first d-c generators of so high a rating to be produced by any electrical manufacturer and represent an engineering achievement in themselves. It is interesting to note that forced lubrication is applied to this set, which is driven by a 12,000-hp synchronous motor, making it possible to start it with less than normal kva even though neutral reactor starting is used.

✦ ✦ ✦

THE motors for driving the stands are unique in that they employ "offset" pole-face windings for the first time. With these special windings, almost perfect compensation can be obtained for armature reaction which, as is generally known, tends to give the motor a rising speed characteristic if not properly compensated for. Thus, with almost perfect armature reaction compensation, it is possible to use full compensation for IR drop in the motor armatures without fear of obtaining a rising speed characteristic which is fatal to any tandem mill. With this combination of armature reaction and IR compensation, almost perfect speed regulation is obtained at all speeds, and accurate tensions are obtained at all times during acceleration, running, deceleration and threading.

✦ ✦ ✦

THESE IR compensating boosters are controlled by amplidyne exciters which give much more accurate and faster response to changes in armature current than the conventional methods of controlling through ordinary exciters. The amplidyne circuits are so arranged that there is a very definite stabilizing effect on the individual motor speeds, extremely important on a high-speed mill of this nature.

✦ ✦ ✦

(*Please turn to Page 266*)

Leading Wire Manufacturers With Wartime Contracts Today USE Bell-Mine Pulverized Lime In Wire Drawing Processes

UNIFORM PURITY OF BELL-MINE LIME IS ASSURED BECAUSE

1st The limestone is mined from the Bellefonte vein many feet below ground, and kept free of any surface dirt and foreign stone by all-mechanical handling from mine to crusher to rotary kilns; and

2nd All steps in processing are under constant engineering supervision, both the raw stone and the burned lime from the large rotary kilns being continually analyzed and tested for their quality-uniformity, by trained chemists at the Warner Plant Laboratory.

Warner Company

BELLEFONTE DIVISION

SALES OFFICES: PITTSBURGH, PHILADELPHIA, BELLEFONTE, N. Y. CITY

NEW—OUTSTANDING!

The Trauwood PROCESS

TEMPERING—PATENTING—ANNEALING

Steel Mill installations for wire and strip have proved these advantages:

Faster Speeds — Greater Production

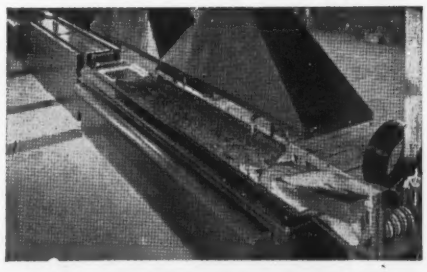
Better and More Uniform Physical Properties

No Decarburization—Practically No Scale

Extremely Accurate Control of Heating and Cooling Rates

Exceptionally High Thermal Efficiency

Overall Low Cost Operation



Trauwood Electric Wire Tempering and Patenting Unit

Complete Details of the Trauwood Process Will Be Furnished You On Request. Our Engineers Are At Your Service. Write Today.

THE TRAUWOOD ENGINEERING COMPANY

1740 E. 23rd STREET, CLEVELAND, OHIO, U.S.A.

NEW ENGLAND BUTT COMPANY
ESTABLISHED 1842
BUILDERS OF
Insulated Wire Machinery
Write for catalog
Dept. W-5 PROVIDENCE, R. I.

FOR DEFENSE
FOR OFFENSE
FOR COMMERCE
ROBINSON Stranders meet the requirements of the industry; which is called upon to furnish stranded wire in ever increasing quantity.
Robinson Engineers will give your inquiries their prompt and careful attention. Write —
ROBINSON MANUFACTURING COMPANY
MUNCY, PA.

WOOD•REELS•METAL
Don't let scarcity of metals slow down your production.
Wood products are being used more and more in place of metal.
For half a century we have filled the wood spool and reel needs of the wire industry.
Let us fill your requirements for SPOOLS and REELS (all wood or metal covered)
BLOCKS, DISCS, DOWELS, HANDLES, IDLER PULLEYS, PLUGS, RADIO PARTS, ROLLERS, WEDGES, and so forth.
Also low-priced non-returnable spools and reels with paper cores.
Send Samples or Drawings For Estimates to
AMERICAN WOOD WORKING COMPANY
1658 No. Lowell Avenue
Chicago, Ill.
Telephone: Belmont 0243

Electrical Developments in the Steel Industry During 1941

(*Continued from Page 265*)

FURTHERMORE, the motors are designed with such a low WR^2 that it is possible to accelerate the mill to maximum speed in six seconds and decelerate it in four seconds. This has been made possible by designing all motors—except that driving the No. 1 stand—for direct connection, by using double-armature construction on the motors for driving the No. 4 and No. 5 stands as well as the reel, and by using a special "fluted" armature construction which enables the use of much smaller armature diameters.

✦ ✦ ✦

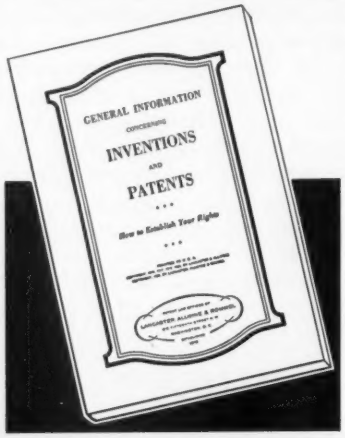
THE control system also includes many new and novel developments such as amplidyne control of voltage during acceleration, running, deceleration, and threading; amplidyne control of tension for the winding reel; tensiometers for indicating strip tension between stands at all times; "tapered" tension for obtaining more accurate gage during acceleration and deceleration; and indirect excitation of the motors. The latter eliminates the usual large motor-operated rheostats, and enables motor speed to be quickly and accurately adjusted by small hand-operated rheostats on the operator's panels.

✦ ✦ ✦

A NOVEL 3-stand tandem mill is being built for rolling strip up to 16 in. wide at a speed in excess of 2000 fpm. The stands are driven by motors of 1250-hp, 1500-hp, and 1000-hp, respectively and the reel by a 200-hp motor. This probably represents more power applied to a mill of this size than ever before. In addition to the features described just previously, this mill is equipped with special reel control. Since this mill will roll an extremely wide range of products, a regulating tensiometer is required for the reel to control the tension accurately.

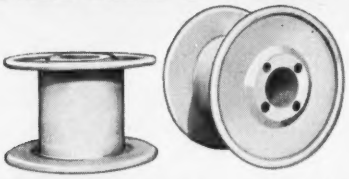
✦ ✦ ✦

REGULATING tensiometers for the two tension reels of a reversing cold-strip mill were placed in service during 1941 with most gratifying results. This repre-



Send for a copy - it's free.
Interesting Booklet concerning Inventions, Patents, Trade-Marks and Copyrights, together with Schedule of Government and Attorney's fees, sent free on request. Simply ask for "booklet and fee schedule."
No charges are made for preliminary advice, either in connection with patent, trade-mark or copyright cases.
Lancaster, Allwine & Rommel
Registered Patent & Trade-Mark Attorneys
438 Bowen Bldg., Washington, D. C.

APCO MOSSBERG
STEEL REELS & SPOOLS



For The Copper, Steel, & Wire Rope Industry

Apco Mossberg Steel Reels are standard equipment in the wire industry—and for good reason! Apco Mossberg—the original Frank Mossberg Co.—**originated** the steel reel idea and have been training workmen in their manufacture ever since. Personal attention by Apco Mossberg engineers make each job a "special".

FREE ENGINEERING SERVICE

We will gladly submit drawings, blueprints, or suggestions without obligation to you. Write for quotation today.

APCO MOSSBERG CO.
(The Original Frank Mossberg Co.)
21 Lamb Street, Attleboro, Mass.

Have You a Drawing Problem?

WIRE DRAWING LUBRICANTS
for every purpose

G. WHITFIELD RICHARDS
1732-36 Carlton St.
PHILADELPHIA, PA.

sented the first application of this kind, and was employed because of the wide range of tension control required. Amplidyne exciters were used in connection with the tensiometers to control the tension.

✦ ✦ ✦

Hot Strip Mills

THE modernization of one hot-strip mill to make it wider and faster was completed in 1941, and represents a striking example of ingenuity in modern development. This mill was completely revamped, involving some new motors, the shifting of other motors, new generators, complete new switchgear, and new d-c run-out tables and coilers. This change was made gradually with almost negligible interruption of regular operations.

✦ ✦ ✦

A MODERN 5-stand continuous hot-strip mill was built for rolling aluminum and represents the first and largest of its kind. Each stand is driven by a 4500-hp motor. Power is supplied from three 4000-kw generators, each driven by a 5800-hp motor. An amplidyne type of voltage-maintenance control has been developed for hot-strip mills to give faster response and more accurate regulation.

✦ ✦ ✦

Rod Mills

THERE has been notable activity in rod mills, and the electric equipment for two such mills is being built at present. It is interesting to note that these are of the continuous type with individual driving motors for the various stands. One of these mills is driven by nine motors aggregating 7650 hp, and the other by eleven motors totaling 9350 hp. In the design of these motors, particular attention has been given to reduce to a minimum impact-speed drop and "ballooning" or over-shooting in speed on recovery.

✦ ✦ ✦

(*Please turn to Page 268*)

HELPS SPEED-UP WAR PRODUCTION!

Today . . . speeding up war production is the wire industry's NUMBER ONE job! In many well-known wire mills, Oakite Composition No. 24 and other Oakite materials help INCREASE OUTPUT in degreasing and drawing wire.

Their standardized use has also contributed materially to the establishment of such other outstanding, money-saving advantages as (1) longer die life, (2) brighter wire, and (3) shorter baking time.

We shall be glad to work with you and make tests to HELP YOU establish the same results in your mill. Since there is no obligation, won't you write us today?

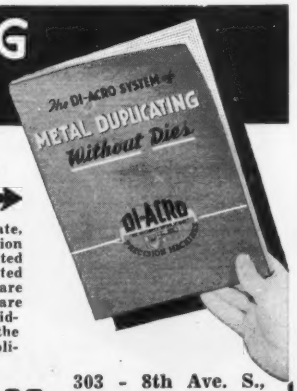
OAKITE PRODUCTS, INC.
52A THAMES ST. NEW YORK, N. Y.
Representatives in All Principal Cities of U. S. and Canada

OAKITE CERTIFIED CLEANING
MATERIALS · METHODS · SERVICE

METAL DUPLICATING *Without Dies*

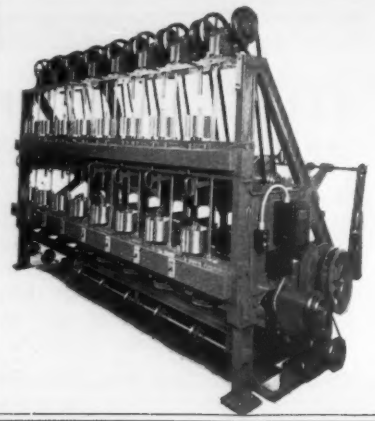
NEW CATALOG SHOWS
Cost-Cutting, Time-Saving Methods

If you have experimental parts to form or quantities to duplicate, send for this new catalog today. It shows how Di-Acro Precision Machines—Bender, Brake, Shear—produce an almost unlimited variety of intricate shapes, accurate to .001" on all duplicated work. The Di-Acro System forms angle, channel, round or square tube, rod, moulding; round, half-round, square or flat wire, strip stock, etc.—frequently avoiding expense and time delay of Dies. Get the facts on the Di-Acro System of "Metal Duplicating Without Dies"—write for catalog.



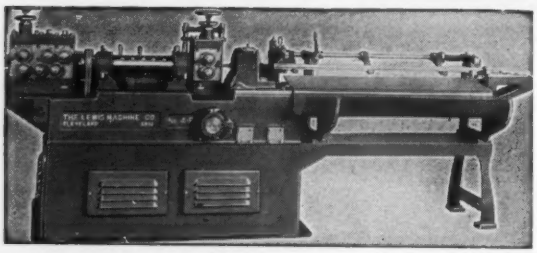
DI-ACRO "THE ACCURACY WITHOUT DIES" PRECISION MACHINES

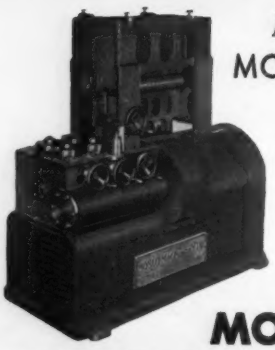
O'NEIL-IRWIN MFG. CO. 303 - 8th Ave. S., Minneapolis, Minn.



AIMco
2D8-MBB Machine
for applying
FIBERGLAS,
COTTON AND PAPER
Each Unit Individually
Motor Driven
WIRE MACHINES FOR
Drawing, Enameling, Tinning, Spooling,
Multiple Pull-outs, Rubber Covered
Wire Panners, etc.
EST. 1885 AIMco INC. 1918
"American"
INSULATING
MACHINERY
COMPANY
517 West Huntingdon St.
PHILADELPHIA PENNSYLVANIA U.S.A.

NILSON
AUTOMATIC PRESS
AND
FOUR SLIDE MACHINE
FOR SWAGING, STAMPING, PIERCING, BLANKING,
FORMING OF COILED METAL
WE also build machines for forming Paper Clips, Buckles, Gate Hooks, Coat and Hat Hooks, Ceiling Hooks, Wire Ears, Cable Rings, Screw Eyes, Sash Chains, Automobile Side Chains, Flat Open Link Chains, Staples, Cotter Pins, Hose Clamps, Etc., and Wire Straighteners, Wire Reels, Frame Bending Machines and Special Presses.
For Complete Details Address —
THE A. H. NILSON MACHINE CO.
BRIDGEPORT, CONN., U. S. A.

LEWIS TRAVEL-CUT WIRE STRAIGHTENING and CUTTING Machines

Machines for 1/16" to 3/4" rod
Round
Square
Flat
Hexagon
Ferrous and Non-Ferrous
Automatic
High Speed
Heavy Duty
The Sign of Dependable Service:
WE CAN SUPPLY AND ENGINEER OUR TOOLS EQUIPPED WITH CARBOLOY CEMENTED CARBIDE
THE LEWIS MACHINE CO., 3445 E. 76 St., Cleveland, Ohio


Designed For Speed And Stamina
MOSLO AUTOMATIC WIRE FEEDER
★ Modernize your welding rod manufacturing equipment by installing a MOSLO AUTOMATIC WIRE FEEDER. The precision and durability of this machine guarantees efficient, economical operation.
Write Today For Free Folder
MOSLO MACHINERY, Inc.
4518 SUPERIOR AVENUE CLEVELAND, OHIO

Electrical Development in the Steel Industry During 1941

(*Continued from Page 267*)

Wire Drawing

IN this field there has been exceptional activity and a hundred equipments for wire drawing have been built, or are being built. This involves both wound-rotor a-c shunt-wound motors and control. Much experience has been gained in the design of the proper resistors for such drives, as well as the operating features required.

✦ ✦ ✦

OUR first equipment for a d-c multimotor block was designed, built, and put in operation during 1941. Adjustable-voltage control was employed with several new features of control as compared with previous installations, providing greater flexibility in acceleration and deceleration between preselected speeds, as well as new jogging or inching features. Tensiometers for indicating purposes were also developed and applied so that the effects of various tensions can be studied.

✦ ✦ ✦

TWO 1500-kw and one 1000-kw, 250-volt rectifiers have been supplied to furnish power for wire-drawing machines during the year past. These are the first such applications.

✦ ✦ ✦

Draw Benches

A GREAT number of draw-bench applications were made during 1941 employing "torque-continuity" control for very smooth acceleration of multispeed induction motors. A contact-making wattmeter with adjustable contacts has been developed to indicate, more accurately, slippage of the clamp and the completion of the draw.

✦ ✦ ✦

Flying Shears

A COMBINATION vacuum-tube and amplidyne control for flying shears, which eliminates the necessity of a mechanical tie to the last stand of a hot-strip mill, has been in operation for over a year. The results have surpassed the best expectations.

Processing Lines

NUMEROUS trimming and shearing lines, galvanizing lines, cleaning and pickling lines, recoiling lines, and the like were either modernized and speeded up or built new during 1941. Amplidyne control has played an important role in all of these applications. One line is particularly interesting in that a single amplidyne was used to control three tension reels.

✦ ✦ ✦

A NEW loop control, utilizing a photoelectric "eye" and thyratron control for maintaining loop depth accurately in a processing line, has been developed and applied. This does away with the necessity of either mechanical or photoelectric limit switches and their attendant speed fluctuations.

✦ ✦ ✦

New Booklet Aid to Instrument Users

A CLEAR, concise explanation of how the national defense program affects purchase, use and maintenance of temperature measuring and control instruments is given in Defense Bulletin No. 1, issued by Wheelco Instruments Co., Harrison & Peoria Sts., Chicago.

✦ ✦ ✦

THE bulletin has been issued to aid industrial instrument users in defense and non-defense industries to gain maximum life and efficiency from pyrometric equipment now installed and being installed. It will be supplemented by similar informational bulletins, if required.

✦ ✦ ✦

DEFENSE Bulletin No. 1 is designed to aid all users of pyrometers, regardless of make, to maintain equipment so it will operate efficiently and give uninterrupted service. It suggests substitute materials that may be employed in place of materials made critical because of the war program, and compares the properties of the original and substitute materials.

✦ ✦ ✦

COPIES may be had by addressing the company.

Learn about PARALAN

Paralan will give your finished wire and wire products protection from atmospheric corrosion in the mill and in shipping. Paralan-coated wire can be spot welded or soldered without cleaning. Also, Paralan leaves surfaces in good condition for all types of finishes—enameling, japanning, lacquering, plating, etc.

Write for further information. We may be able to solve your difficulties.

AMERICAN LANOLIN CORP.
LAWRENCE, MASSACHUSETTS

WIRE DRAWING LUBRICANTS
HIGH OR LOW CARBON WIRE, COLD HEADING, BRIGHT AND WET WIRE DRAWING.
STANDARD "WIRE DRAW"
SPECIALLY ADAPTED FOR HIGH SPEED DRAWING MACHINES
BETTER FINISHED WIRE — LOWER DIE COSTS
STANDARD INDUSTRIAL COMPOUNDS CO.
CHICAGO, ILLINOIS

STEELSKIN
REG. U. S. PAT. OFFICE
For High or Low Carbon Wire
WIRE DRAWING SOAPS
Established 30 years
R. H. MILLER CO., Inc. Homer, N. Y.

WIRE MILL EQUIPMENT *by* "STANDARD"

TURKS HEADS
Adjustable draw plates—accepted by wire trade as accurate, efficient means of producing rectangular and special shapes. With friction or power driven rolls. Catalog TH.

DRAW BENCHES
8 sizes, 2 general types. Machines are of one-man type with all controls at die end. Catalog DB.

ROLLING MILLS—STRIP AND WIRE
Roller bearing and plain bearing mills; many regular sizes or made to suit user's specific needs. Write fully.

SWAGING MACHINES
For reducing diameter of tubular and solid bar stock into cylindrical, conical, or "necked" shapes. Capacities from ½" tube, ¼" solid to 6" tube or 3¾" solid. Catalog SM.

ALSO
Hand Screw, Foot, and Power Presses; Drop Hammers, and Scrap Bundlers.

✓ your needs for this equipment and write for catalogs.

STANDARD MACHINERY CO., PROVIDENCE, R. I.

GREATER WIRE-DRAWING MILEAGE RECORD

BALLOFFET
DIES AND NOZZLE CO., Inc.
6825 Adams St., Guttenberg, N. J.
Quality Diamond Dies Since 1870

Precision Gage

THE Federal Products Corporation, Providence, R. I., manufacturers of precision measuring instruments, announces the perfection of a pitch diameter gage said to be an efficient and inexpensive gage for inspecting pitch diameters of all kinds of threads.

✦ ✦ ✦

THIS gage is simple mechanically and is suited to British as well as United States threads, and approximates the three-wire method of inspecting threads.

✦ ✦ ✦

Mounting of Points on Model 45-B-80 ✦

THE illustration shows the independent mounting of the points. The gage is said to have been thoroughly proven in the hands of several machine screw concerns and has met the requirements of people whose pitch and diameter inspection has been most exacting, and is of immediate importance for the inspection of threads in connection with the production of war material.

For Best Results, Use

WILLEY'S
TUNGSTEN CARBIDE DIES

- WIRE DRAWING
- EXTRUSION
- SIZING

They have exceptional abrasion resistance, are free from porosity and take a high polish. Standard one-piece round dies from stock in many sizes. Four classifications from blank and rough cored nibs to finished dies, ready to use.

WRITE FOR CATALOG
Full information on all sizes and classifications.
Sales Engineers in Principal Cities

WILLEY'S CARBIDE TOOL CO.
MANUFACTURERS AND SPECIALISTS IN
TUNGSTEN CARBIDE TOOLS
1340 W. VERNOR HIGHWAY • DETROIT, MICHIGAN

VIANNEY
Famous Wire Drawing Diamond Dies

These famous Diamond Dies are now produced here at moderate prices.

All sizes are in stock or made to order to your specifications

VIANNEY WIRE DIE WORKS
250 E. 43rd. St. New York.
V. J. Boulin, Manager

Wire Drawing and Extrusion Dies made of DIAMONDS, COMPOSITION, etc.
F. KRAUSE & CO.
202 Pennsylvania Ave., Hillside, N. J.
Phone Elizabeth 2-1109

DIAMOND DIES
.000's to .102
Fort Wayne Wire Die, Inc.
2002 S. Harrison Fort Wayne, Ind.

For the Finest DIAMOND WIRE DRAWING DIES
Look for the mark W.W.D.CO.

Particulars and Prices on Request

What do you want in diamond dies? Diamonds of best quality; workmanship that is accurate; and dies that will give the utmost in life and the highest flawless output of wire.

Every WAYNE die will meet these requirements. Use WAYNE dies to cut your costs. Least expensive in the long run.

Users of WAYNE dies state that "they are the best value obtainable".

Wayne Wire Die Company 200 PENNSYLVANIA AVE., HILLSIDE, N. J.
Telephone: ELizabeth 2-2456

Wire Drawing Diamond Dies

COCHAUD

WIRE DIE CORPORATION

300 W. 56th St., NEW YORK

Tel. Col. 5-1340

DIAMOND AND CARBIDE WIRE DRAWING DIES

RUSCH WIRE DIE CORPORATION
275 Seventh Ave., New York, N. Y.

DIAMOND WIRE DRAWING DIES

INDIANA WIRE DIE COMPANY
1207 E. Creighton Ave.
Fort Wayne, Indiana

DIAMOND CARBIDE DIES

KELLY

WIRE DIE CORPORATION

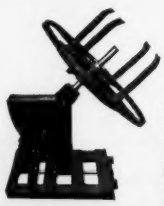
19 W. 34th St. New York

WIRE MACHINERY SPECIALISTS

3—Nilson No. 1, 3 & 4 4 Slide Wire Machines
5—Baird No. 4—Four Slide Wire Machines
7—Waterbury Step Cone Wire Drawing Machines
1—Two Spindle Bull Block Motor Driven
6—Lewis Welding Wire S. & C. Machines M. D.
2—Shuster Shaped Wire S. & C. Machines ⅛" & ¼" Square, Hexagon & Round Stock Capacities
8—Shuster Round Wire Straightening & Cutting Machines 1/32"-½"

Wanted: Tack Making Machinery. All Sizes.

NATIONAL MACHINERY EXCHANGE
128-138 MOTT ST. NEW YORK, N. Y.



UNIVERSAL WIRE REEL

Quickly and easily adjusted to any angle within 90 degrees. Cut shows one angle.

Write for circular R

THE F. B. SHUSTER CO.

New Haven, Conn.

Straightener Specialists Since 1866

WANTED

Used Sleeper & Hartley or Torrington Universal and Torsion Spring Coilers with automatic cutoff, all sizes. Reply direct to

CHISWELL WIRE CO., LTD.
WATFORD, ENGLAND
or through
Philipp Brothers, Inc.
70 Pine Street, New York City

CONSULTANT AND SPECIALIST

DRAWING LUBRICANTS

Hans C. Bick, Inc.

READING, PA.

Protect Those Eyes

INDUSTRIAL eye accidents during 1941 robbed America of approximately 9,500,000 man-days, enough working time to have built 17 destroyers, according to **Ira Mosher,** vice president of the American Optical Company.

✦ ✦ ✦

REPORTING an increase of 1,000,000 lost man-days during 1941 in comparison with 1940, he declared that 98 per cent of the 300,000 eye injuries which occurred are preventable. The direct and indirect cost of these accidents to the country, he said, totals $200,000,000.

✦ ✦ ✦

STATING that the increase in eye accidents is out of proportion to new men employed, he warned that the loss of time and production is materially affecting the war effort.

✦ ✦ ✦

MOST of the human suffering and financial loss resulting from these accidents could be averted, he added, if employers and employees universally adopted proven methods of eye-accident prevention.

Hy-Carbo Steel Co.

EST. 1917

✦ ✦ ✦

EQUIPMENT AVAILABLE FOR REDRAWING ROUND WIRE

Less Ton Lots A Specialty

✦ ✦ ✦

LOWELL, MASS.

GEORGE D. HARTLEY

CONSULTANT & SPECIALIST

In Wire Manufacturing & Wire Forming Equipment

Development & Research
New Processes — Designing
Inventions — Patents

372 MAY ST., WORCESTER, MASS.

KENNETH B. LEWIS
CONSULTING ENGINEER

Wire Mill Equipment, Layout and Practice

43 Midland St., Worcester, Mass.
Phone: Worcester 5-6033

Come to the Wire Association Pittsburgh Regional Meeting, William Penn Hotel, Pittsburgh, Friday, May 22nd, 1942—6:00 P. M.

NEW RICHMOND

Kentucky Avenue Just Off Boardwalk

ATLANTIC CITY, N. J.

★

European Plan—
Moderate Rates

★

ALL OUTSIDE ROOMS, MOST OF WHICH HAVE OCEAN VIEW

★

AMPLE LOBBIES AND PARLORS IN A SPIRIT OF HOME-LIKE REFINEMENT

★

Write for Literature and Rates

William Kneller, Owner

EYELETS
ZINC WIRE
ZINC STRIP
THE PLATT BROS. & CO.
WATERBURY, CONN.

Designers and Builders of Gas-Fired Heat Treating Furnaces for Ferrous and Non-Ferrous Wire.
SURFACE COMBUSTION
Main Plant & General Offices - Toledo, Ohio

WIRE DRAWING MACHINERY AND EQUIPMENT
Rod Frames — 16" Frames, 8" Frames — Take-Up Frames, Wire Pointers — Puller Tongs.
General and heat resisting alloy castings for wire mill use.
Circulars on Request.
E. J. SCUDDER FOUNDRY & MACHINE CO.
TRENTON, N. J.

RUESCH
Machinery For
Wire, Tube, and Brass Mills
409 Mulberry St., Newark, N. J.

BRODEN
Wire Mill and Cold Rolling Equipment
Broden Construction Co.
22800 Lakeland Blvd.
CLEVELAND, OHIO

ACID PROOF BRICK
for
Pickling Tank Construction
Toronto Acid Brick
KEAGLER BRICK COMPANY
STEUBENVILLE, OHIO

ROSS ROD • WIRE BAKER
J. O. ROSS ENGINEERING CORP.
350 Madison Avenue, New York, N. Y.
CHICAGO DETROIT

RODINE
CHEMICALS ACP PROCESSES
Use Rodine in the Pickling Bath to Prevent Smudging and Acid Brittleness.
AMERICAN CHEMICAL PAINT CO.
AMBLER, PA.

Norton Awarded the Navy "E"

THE Navy "E" is the highest service award the Navy bestows and is a symbol of efficiency, excellence and achievement.

✦ ✦ ✦

AN "E" painted on the funnel, turret or conning tower of a Navy ship designates distinguished gunnery, engineering or other outstanding performance. Crews which win the "E" for engineering paint the letter on the funnel, for gunnery they paint it on mast or bridge. Turret crews who win the letter paint it on their turret.

✦ ✦ ✦

THE idea of honoring manufacturers and workers for conspicuous, cooperative and effective production of material for the Navy was promulgated by Rear Admiral W. H. P. Blandy, Chief of the Bureau of Ordnance, endorsed by Secretary Knox and approved by President Roosevelt. It is a recognition of independent effort by industry, of ingenuity and solving difficult ordnance production programs.

✦ ✦ ✦

AS authorized by the President of the United States and directed by the Secretary of the Navy, those manufacturing companies who qualify are permitted to fly the Navy "E" Pennant over their plant, and all employes of such plants are awarded an emblem in the form of a lapel button bearing the Navy insignia.

✦ ✦ ✦

THE presentation was made by **Admiral Wat Tyler Cluverius, U.S.N.**, representing the Secretary of the Navy, at the Norton Field House, on Monday, March 23d.

FOR SALE
Complete wire rod cleaning plant with oven and hoists. Also modern wire drawing machines. For details write BOX #336 c/o
WIRE & WIRE PRODUCTS

ROYLE
PATERSON N J
BUILDING EXTRUDERS SINCE 1880
Royle insulating, straining and tubing machinery --- famous fifty years.
JOHN ROYLE & SONS
PATERSON, N. J.
British Agency: James Day (Machinery) Ltd., The Grange Whetstone Nr. Leicester, England

WATERPROOF
and
CREPE PAPER
in rolls of any size for wrapping coils and reels.
CREPE-KRAFT BARREL LINERS
THE CREPE-KRAFT COMPANY
Tel.: Market 2-0375
112 Adams St. Newark, N. J.

DAVIS
SPARKERS
R. L. DAVIS ELECTRIC CO.
340 Center Street,
Wallingford, Conn.

WIRE SPOOLING MACHINERY
and
SPECIAL MACHINERY
Address inquiries to
ROBERT J. EMORY COMPANY
Sherman Ave. & Runyon St.
Newark, N. J.

Annealing Pots and Boxes
Galvanizing Kettles
Lead and Spelter Pans
Pressure Vessels
NATIONAL ANNEALING BOX CO.
Established 1895
Washington, Penna.

FOR YOUR SPOOLS AND REELS
Patented all-steel electro-welded Drawing and Annealing and patented metal-bound shipping spools and reels.
Hubbard Spool Company
1624 Carroll Avenue, Chicago, Illinois

SCOTT TESTERS
For WIRE, RUBBER, TEXTILES, PAPER, Etc.
HENRY L. SCOTT CO.
PROVIDENCE, R. I.

WIRE, WIRE ROPE AND ELECTRIC CABLE MACHINERY
THOMSON-JUDD
WIRE MACHINERY COMPANY
SUBSIDIARY OF THOMSON-GIBB ELECTRIC WELDING COMPANY
LYNN, MASSACHUSETTS
WRITE FOR CATALOGUE

Index to Advertisers

A

Alrose Chemical Company 258
American Chemical Paint Co. 272
American Insulating Machinery Co. 268
American Lanolin Corp. 269
American Wood Working Company 266
Apco Mossberg Co. 267

B

Balloffet Dies & Nozzle Co., Inc. 270
Bellis Heat Treating Co., The 260
Bethlehem Steel Co. 226
Bick, Hans C., Inc. 271
Broden Construction Co., The 272

C

Callite Tungsten Corp. 263
Carboloy Company, Inc. 225
Carl-Mayer Corp., The ..... Inside Front Cover
Clark, J. L., Mfg. Co. 264
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co. 227
Cochaud Wire Die Corp. 271
Continental Steel Corp. 229
Crepe-Kraft Co., The 272

D

Davis, R. L., Electric Co. 272
Durant Mfg. Company 259

E

Electric Furnace Company ..... Back Cover
Emory, Robert J., Co. 272

F

Fidelity Machine Co. 233
Firth-Sterling Steel Co. 236
Fort Wayne Wire Die, Inc. 270

G

Glader, Wm., Machine Works 262

H

Hartley, Geo. D. 271
Hubbard Spool Company 272
Hudson Wire Company ..... Inside Back Cover
Hy-Carbo Steel Company 271

I

Indiana Wire Die Co. 271

J

Jones & Laughlin Steel Corp. 231

K

Keagler Brick Co. 272
Kelly Wire Die Corp. 271
Keystone Steel & Wire Co. 253
Krause, F. & Co., The 270

L

Lancaster, Allwine & Rommel 266
Lewis, K. B. 271
Lewis Machine Co., The 268

M

Micro Products Co. 251
Miller, R. H., Co., Inc. 269
Morgan Construction Co. 234
Moslo Machinery, Inc. 268
Mossberg Pressed Steel Corp. 257

N

National Annealing Box Co. 272
National Erie Corp. 249
National Machinery Exchange 271
New England Butt Co. 266
New Richmond Hotel 271
Niagara Blower Company 256
Nilson, A. H., Machine Co. 268
Norton Company 264

O

Oakite Products, Inc. 267
O'Neil-Irwin Mfg. Co. 267

P

Platt Bros. & Co., The 272

R

Richards, G. Whitfield 267
Robertson, John Co., Inc. 252
Robinson Mfg. Company 266
Ross, J. O., Engineering Corp. 272
Royle, John & Sons 272
Ruesch, H. J., Machine Co. 272
Rusch Wire Die Corp. 271

S

Scott, Henry L., Co. 272
Scudder, E. J., Foundry & Machine Co. 272
Shuster, F. B., Co. 271
Sleeper & Hartley, Inc. 243
Standard Industrial Compounds Co. 269
Standard Machinery Company 269
Stevens Metal Products Co., The 235
Surface Combustion, Div. of General Properties Co., Inc. 272
Syncro Machine Co. 228

T

Thomson-Judd Wire Machinery Co. 272
Trauwood Engineering Co., The 265
Tungsten Electric Corp. 255

V

Vascoloy-Ramet Corp. 230
Vaughn Machinery Co. ..... Front Cover
Vianney Wire Die Works 270

W

Warner Company 265
Waterbury-Farrel Fdry. & Machine Co. 232
Watson Machine Co. 254
Wayne Wire Die Co. 270
Willey's Carbide Tool Co. 270

WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

AIR DRAW FURNACES—
Carl-Mayer Corp., The, Cleveland, Ohio

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Rahway, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

BAKERS—Hi-Speed
Carl-Mayer Corp., The, Cleveland, Ohio

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Moslo Machinery, Inc., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

BERYLLIUM COPPER—Strip and Bars
Callite Tungsten Corp., Union City, N. J.

BOBBINS—Braider and Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRICKS—Acid Proof
Keagler Brick Co., Steubenville, Ohio

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIPMENT—
Broden Construction Co., Cleveland, Ohio
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

CLOTH—Wire, All Metals
Callite Tungsten Corp., Union City, N. J.

COATING—Protective
American Lanolin Corp., Lawrence, Mass.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.

COLD HEADERS—
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

WHERE TO BUY, Continued

COMPOUNDS—Wire Drawing
Oakite Products, Inc., New York, N. Y.
Richards, G. Whitfield, Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CONTROLS—Heat Treating
Niagara Blower Co., Buffalo, N. Y.

CONTROLS—Temperature
Niagara Blower Co., Buffalo, N. Y.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUSTOM WIRE DRAWING—
Hy-Carbo Steel Co., Lowell, Mass.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

DIAMONDS—Industrial
Callite Tungsten Corp., Union City, N. J.

DIAMOND POWDERS—
Rusch Wire Die Corp., New York, N. Y.

DIAMOND TOOLS—
Rusch Wire Die Corp., New York, N. Y.

DIE MAKING MACHINERY — For Forming Special Shapes
O'Neil-Irwin Mfgr. Co., Minneapolis, Minn.

DIES—Diamond
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Cochaud Wire Die Corp., New York, N. Y.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Hillside, N. J.
Rusch Wire Die Corp., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Lead Extrusion
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Fort Wayne Wire Die, Inc., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Krause, F., & Co., Hillside, N. J.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod & Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., New York, N. Y.
Tungsten Electric Corp., Union City, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Works, New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIRECT ELECTRIC RESISTANCE HEAT TREATING—
Trauwood Engineering Co., Cleveland, Ohio

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Stevens Metal Products Co., Niles, Ohio

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING EQUIPMENT—
Niagara Blower Co., Buffalo, N. Y.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Humidifying
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Industrial Cooling
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FINISHES—Wire
Alrose Chemical Co., Providence, R. I.

FLASH BAKER—
Carl-Mayer Corp., The, Cleveland, Ohio

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

FURNACES—Annealing
Bell's Heat Treating Co., The, Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engineering Co., Cleveland, Ohio

FURNACES—Automatic
Bell's Heat Treating Co., The, Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Bell's Heat Treating Co., The, Branford, Conn.
Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Electric
Bell's Heat Treating Co., The, Branford, Conn.
Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engineering Co., Cleveland, Ohio

FURNACES—Hardening & Tempering
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio
Trauwood Engineering Co., Cleveland, Ohio

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio
Robertson, John, Co., Brooklyn, N. Y.

FURNACES—Non-Oxidizing
Bellis Heat Treating Co., The, Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio

FURNACES—Normalizing
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio

FURNACES—Salt Bath
Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Bellis Heat Treating Co., The, Branford, Conn.
Carl-Mayer Corp., The, Cleveland, Ohio
Electric Furnace Co., Salem, Ohio
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HI-SPEED BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

INHIBITORS—
American Chemical Paint Co., Ambler, Pa.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Morgan Construction Co., Worceater, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Bick, Hans C., Inc., Reading, Pa.
Miller, R. H., Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Bunching
American Insulating Mach'y. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y. Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Coilers
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

WHERE TO BUY, Continued

MACHINERY—Covering Wire
Fidelity Machine Co., Philadelphia, Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Cutting
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery, Inc., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Die Making
Firth-Sterling Steel Co., McKeesport, Pa.

MACHINERY — Die Making for Forming Special Shapes
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Draw Benches
Standard Machinery Co., Providence, R. I.

MACHINERY—Edging
Standard Machinery Co., Providence, R. I.

MACHINERY—Enameling
American Insulating Mach'y. Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Extruding
National Erie Corp., Erie, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Forming
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, Ohio
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
National Erie Corp., Erie, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John, Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Davis, R. L., Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wis.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Quill Winding
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
National Erie Corp., Erie, Pa.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Strip Covering
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Emory, Robert J., Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, Ohio
Lewis Machine Co., The, Cleveland, Ohio
Moslo Machinery, Inc., Cleveland, Ohio
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing
Robinson Mfg. Co., Muncy, Pa.
Scott, Henry L., Co., Providence, R. I.

MACHINERY—Testing Size of Wire
Davis, R. L., Electric Co., Wallingford, Conn.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Welding Wire
Micro Products Co., Chicago, Ill.
Shuster, F. B., Co., New Haven, Conn.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Robinson Mfg. Co., Muncy, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Sub. of Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Rahway, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.

WHERE TO BUY, Continued

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Richards, G. Whitfield, Philadelphia, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

PICKLING TANK LININGS—
Keagler Brick Co., Steubenville, Ohio

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lead Melting
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Richards, G. Whitfield, Philadelphia, Pa.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

QUENCHING BATH CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Moslo Machinery, Inc., Cleveland, Ohio
Robinson Mfg. Co., Muncy, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Rahway, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
American Wood Working Co., Chicago, Ill.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS AND SPOOLS—Shipping and Shop
American Wood Working Co., Chicago, Ill.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REELS—Takeoff
American Wood Working Co., Chicago, Ill.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Vulcanizing and Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Co., New Haven, Conn.
Stevens Metal Products Co., Niles, O.

REELS—Wire Drawing
American Wood Working Co., Chicago, Ill.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, Ohio
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio
Moslo Machinery, Inc., Cleveland, Ohio
Ross, J. O., Engineering Corp., New York, N. Y.

RODS—Wire—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

ROLL STRAIGHTENERS—
Moslo Machinery, Inc., Cleveland, Ohio

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corp., Lawrence, Mass.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

SPOOLS—Annealing and Wire Drawing
American Wood Working Co., Chicago, Ill.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Shipping and Shop
American Wood Working Co., Chicago, Ill.
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Clark, J. L., Mfg. Co., Rockford, Ill.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, O.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TANK LININGS—Brick
Keagler Brick Co., Steubenville, Ohio.

TANKS—Compound
Watson Machine Co., Paterson, N. J.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.

TEMPERATURE CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Scott, Henry L., Co., Providence, R. I.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Micro Products Co., Chicago, Ill.
Moslo Machinery, Inc., Cleveland, Ohio

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE DRAWING—High Grade Custom
Hy-Carbo Steel Co., Lowell, Mass.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.

WIRE—Enameled for Coils
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE FINISHES—
Alrose Chemical Co., Providence, R. I.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Nickel Silver and Phosphor Bronze
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.

WIRE—Non-Ferrous to Specification for Special Purposes
Callite Tungsten Corp., Union City, N. J.
Hudson Wire Co., Ossining, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Stainless Steel
Callite Tungsten Corp., Union City, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.

HUDSON WIRE COMPANY

PRODUCERS OF FINE WIRES IN ALL METALS

FINE BARE WIRES

High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper.

Cadmium, Nickel Silver, 10%, 18% and 30%; Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

WIRES FOR METAL SPRAYING

Pure Lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity, Electric Wire.

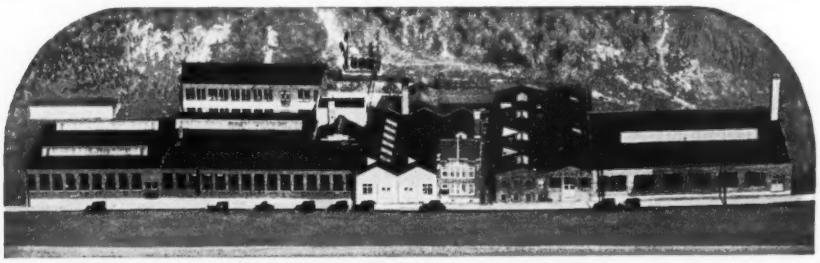
Cadmium, Nickle Silver, (10%, 18%, 30%); Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze.

Look for the name — **HUDCO** — A guarantee of quality

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from Selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

BETTER WIRE AT LOWER COST

Write for Prices and Samples • Let Us Quote on Your Requirements



"HUDCO" PLANT AT OSSINING, NEW YORK

HUDSON WIRE COMPANY

Established in 1902 — Successors to Royle & Akin

OSSINING, NEW YORK

EF FURNACES

For Every Industrial Heat Treating Process

BRASS for CARTRIDGE CASES---Uniformly Annealed
in this EF Gas Fired Roller Hearth Type Furnace
BUILT BY
THE ELECTRIC FURNACE CO.
Salem, Ohio, U.S.A.

Cartridge cases, tank armor castings, shell forgings, bomb and gun parts, machine gun cartridge clips, aircraft and aircraft engine parts, aluminum and magnesium castings, wire and wire products, bolts, springs and many other allied products are being uniformly treated in outstanding production furnaces built by The Electric Furnace Company, Salem, Ohio. We specialize in designing and building production furnaces.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production